TEACHING GUIDELINES
ON
VOCATIONAL STREAM COURSES
(HIGHER SECONDARY EDUCATION)

West Bengal Council of Higher Secondary Education
6, HO CHI MINH SARANI
CALCUTTA-700071
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(Higher Secondary Education)

West Bengal Council of Higher Secondary Education
8, Ho Chi Minh Sarani (Flat No. 17 & 18)
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PREFACE

Vocationalisation at the Higher Secondary level is the basic philosophy of the changed educational pattern in India pursuant to the recommendations of the Kothari Commission (1964-66). Though a note of high hope has been struck by the Kothari Commission to diversify education and syphon off at least 50 percent of student population to vocational channel, the traditional pattern of liberal education and social attitude against launching in uncharted sea seem to have played a deceleration effect on society and motivation of guardians to admit their wards in Vocational Courses at the new scheme of 2-year Higher Secondary Education has been generally poor. Whatever might be reason for this, the effect is particularly felt in the field of teaching the subjects. Due to small enrolment in vocational courses the publishers in the market appear to be loath to venture to publish Text books for these courses and for that matter the intending text book writers are repelled from the job. This state of affair has cast an added responsibility on the Council to publish guidelines on teaching the respective vocational courses in order to bring home to the instructors the scope, extent and depth of the courses prescribed by the Council so that teaching may proceed on the right lines. Since teaching guidelines do not purport to be teaching materials, the instructors are to treat the guidelines as the outlines and the broad coverages of the different areas of study set out in the curriculum and syllabi, so that the spectrum of the course designs at the Higher Secondary stage may be gauged rightly.

Vocational Courses are highly practice-oriented and mostly result-oriented study too and so the emphasis is greater on moulding the functional side of the Courses at the instructional level in such manner that theoretical knowledge of a student may be strengthened by his/her functional skill development. Hence instruction of abstruse theoretical courses have got to be avoided, and instruction of theory and practical experiments should go side by side in order to imbibe meaningful characteristics to the Vocational Courses. Teaching Guidelines, therefore, indicate how the instructors of the courses would look at the contour of course design of the Council as also the level and scope of the courses intended for this stage of education.

The Council has initially introduced on a selective basis only five vocational fields namely, Agriculture, Industry, (Textiles) Technical Courses, Trade and Commerce and Para-Medical Courses considering their present employment base as also employment potentiality. This is, therefore, a bold experiment in the scheme of diversification and vocationalisation of education, the success of which can be ensured only when the students offering vocational courses can be imparted a meaningful course that would go to build up their functional ability. To this direction, the Council's Teaching Guidelines can prove to be of positive value to the instructors at least upto a time till standard text books can be made available to the students, particularly in view of reading references given against each area of study. Nevertheless, it should be made clear that the guidelines are broadly indicative and never comprehensive and the instructor's freedom to supplement the process to strengthen the teaching front is always there since the Council's guidelines are never intended to usurp the basic parameters of teaching which indeed depend greatly on the norms of rationality and teaching techniques on the side of the instructors of the courses.

I express my deep gratitude to the members of the Boards of Studies in respective vocational courses and the experts associated with them for their arduous task in designing teaching guidelines for vocational areas of study at higher secondary stage of education which are unconventional in character aiming at launching in an uncharted sea. Their difficulty in moulding a profitable guideline can better be realised than described. There may, however, be shortcomings here and there in spite of great care exercised by the experts in the task and the Council will certainly welcome constructive suggestions from academic circles for the improvement of the publication. The Council will, indeed, recokon the venture a success if the instructors in the fields of vocations would find the publication useful in the process of rationalising the teaching-learning situation of the vocational courses of the Council.

D. S. Ganguly.
President.
West Bengal Council of Higher
Secondary Education.

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AGRICULTURE

Basic Theory Paper

(Theoretical Classes—140)

Basic Theory :

Syllabus	No. of classes (45 minutes duration)
1. Food and life : (25)	
(a) Introduction	1
(b) Plant, animals and man.	6
(c) Origin of agriculture and the development of civilization.	3
(d) Agricultural Community	
(i) Division of work (labour)	4
(ii) Co-operation and generating village organisation.	8
(e) Modern science and revolution in agriculture.	3
2. Plant forms : (37)	
(a) Cereal	3
(b) Pulse and Oilseed	2
(c) Fruit and vegetable	3
(d) Sugar, spice, leverage	2
(e) Drug narcotic, perfume, essential oil, dye.	1
(f) Fodder, forage	1

Syllabus	No. of classes (45 minutes duration)
(g) Fibre	2
(h) Fuel, timber	1
(i) The plant and its parts	
(i) Seed	2
(ii) Root	2
(iii) Stem and Leaf	4
(iv) Flower and fruit	4
(j) Plant life	
(i) Absorption	2
(ii) Transpiration	2
(iii) Photosynthesis	2
(iv) Respiration	2
(v) Reproduction	2
3. Animal forms : (26)	
(a) Fish	5
(b) Poultry	5
(c) Cattle	5
(d) Sheep and Goat	4
(e) Bee	3
(f) Lac	1
(g) Silkworm	3
4. Climate and Soil : (30)	
(a) Introduction	2
(b) Seasonal variation in Temperature and humidity.	2
(c) Monsoon rains and average rainfall	2
(d) Droughts and Floods	2
(e) High wind and frost	1
(f) Soil	

Syllabus	No. of classes (45 minutes duration)
(i) Introduction	2
(ii) Soil Composition	2
(iii) Soil groups	4
(h) Cultivation pattern	3
(i) Soil and water conservation	8
5. Balance diet: (22)	
(a) Introduction	2
(b) Importance of specialization and co-ordination in agricultural production.	1
(i) Cross production field crops.	2
(ii) Horticulture	2
(iii) Pisciculture	2
(iv) Poultry farming	2
(v) Animal husbandry	2
(vi) Dairy farming	2
(c) Importance of agricultural development as the basis of all round development and social change.	5
(d) Comprehensive Area Development.	2

Plant Forms (Basic Theory)

Cereal—Rice, Wheat, Maize, Barley, Millets.

Pulse—Gram, Kalai, Lentil, Arhar, Pea, Soybean, Cowpea, Mung.

Oilseed—Mustard & Eape, Naiger, Linseed, Sunflower, Groundnut, Sesamum, Cocoanut.

Fruit—Mango, Lichee, Guava, Lims of lemon, Oranges, Jack-fruit, Pineapple, Banana, Papaya, Water-melon, Casuanut, Ber, Sapata, Custered apple, Wood apple.

Vegetable—Cauliflower, Cabbage, Knolkhol, Radish, Carrot, Beet, Calceasia, Potato, Sweet Potato, Brinjal, Tomato, Lady's finger, Cucumber, Gourds, Spainach, Amarauthus, Pui, Drm stick, Lobia, Beans.

Sugar—Sugar cane, Sugar beet.

Spices—Chillies, Coriander, Fenngreck, Mint, Gumin, Fennel, Cardamon, Turmeric, Garlic, Ginger, Onion, Ajwan.

Beverage—Falsa.

Drug & Narcotic—Arecanut, Betelvine, Tobacco, Opium Indian hemp.

Dye—Henna, Madder, Saffron.

Fodder—Jower, Napier, Oat, Phasiolus, Cowpea, Barseem.

Perfume—Keya, Rose.

Essential Oil—Citronellal, Vanilla.

Fibre—Jute, Cotton, Sunhemp, Masta, Sisal.

Fuel—Rain tree, Goldmohar, Kadam, Palas, Acaacia.

Timber—Sal, Segun, Simul, Babul.

LESSON GUIDE FOR TEACHERS

Introductory Note

1. No. of days available for institutional study ... 340
2. No. of weeks available for institutional study $\frac{340}{6}$ ... 56
3. No. of periods allotted for vocational subjects per week. 21
4. Total No. of periods available for vocational subjects 21×56= 1176

5. Weightage on vocational papers as indicated by allotment of marks

(a) Basic Theory	1
(b) Theory Paper III	2
(c) Practical operation—Paper IV	6

6. Distribution of classes according to weightage :

(a) Basic theory	140
(b) Paper III	260
(c) Paper IV	776

N.B. (a) Duration of theory class (paper-III) will be 45 minutes each.

(b) Duration of practical operations (paper-IV) will be 3 hours each. Therefore, number of actual practical classes will be 776/4 (45 minutes × 4 = 3 hours) = 194.

CROP CULTIVATION

Theoretical Class—280 (45 minutes duration)

Practical Classes—198 (3 hours duration)

THEORETICAL

	Syllabus	No. of Classes
1.	Growth of Crop : (28)	
(a)	Growth stages of Crop (Rice, Wheat, Potato and Jute) (i) Morphology of the crop plant and varietal types. ...	8
(b)	Preliminary concept of the physiology related to growth of crop. (i) Phases in growth process. **Vegetative**—from Seed germination to flower initiation. **Reproductive**—from Flower initiation to flowering. **Ripening**—from Flowering to full ripening or in other cases only full ripening.	12

PRACTICAL

	Syllabus	No. of Classes
(a)	Identification of the vegetative and floral organs. ...	4
(b)	Acquaintance with—vegetative phase ... Reproductive phase. Ripening phase.	4

(c) Concept of yield and yield components. (i) What is yield and what are yield components. ...	8	(c) Identification of yield components. ...	4
		Computation of yield by crop cutting methods.	
2. Cultivation : (28)			
(a) Use of different kinds of farm implements. Tillage, sowing, intercultural cultivation, harvesting. ...	28	(a) Different farm implements (i) Acquaintance with common farm implements and their operations. ...	5
		(ii) Dismantling and assembling of mouldboard plough, seed drill, wheel Hoe and rotary Weeder, pumping sets, Power threshers, etc. ...	10
		Measurement and record of temperature and rainfall. ...	5
		Seed Testing and seed dressing (treatment) ...	5
		Determination of Soil texture by feel method. ...	1
3. Manures and fertilizers : (28)			
(a) Role of manures and fertilizers in crop production. ...	2	(a) Different manures and fertilizers. (i) Acquaintance with different methods of fertilizers application—Broadcasting, Placement and foliar spraying. ...	6

Syllabus	No. of classes
(b) Important manures and fertilizers, their properties and uses.	
(i) Organic manure compost, Farm Yard manure, Green manure, Oil cake. ...	8
(ii) Ammonium Sulphate, Urea, Calcium ammonium nitrate, Super phosphate, Potassium chloride, Mixed fertilizers.	14
(c) Compost making and green manuring. ...	4
4. Crop production : (78)	
(a) Cereals. ...	26
(i) Rice. ...	10
(ii) Wheat. ...	8
(iii) Maize. ...	8

Syllabus	No. of classes
(ii) Study of the effect of agricultural chemicals on crop growth and yield. Fertilizer, Insecticide, Fungicide, Harbicide Soil ameliorant and plant hormone. ...	2
(b)	
(i) Identification of different manures and fertilizers (as stated in the theoretical portion). ...	1
(ii) Computation of fertilizers according to recommended dose. ...	1
(c)	
(i) Construction of manure pit and compost making	5
(ii) Raising of green manuring crops and green manure. ...	5
Familiarity with different crop production operating (Seedling raising, transplanting, harvesting, land preparation, etc.) of the important crops, as mentioned in the theory course. ...	67

THEORETICAL		PRACTICAL	
Syllabus	No. of Classes	Syllabus	No. of Classes
(b) Fibre.		Allotment of plots for growing crops by individual students (preferably 1/60th acre for vegetable and 1/60th acre for field crop per season). ...	25
(i) Jute. ...	8		
(c) Tuber.		Participation in village/community cultivation. ...	20
(i) Potato. ...	8		
(ii) Sweet Potato. ...	2		
4. Crop production			
(d) Pulses. ...	8		
(i) Phaseolus Sp. ...	2		
(ii) Gram. ...	2		
(iii) Lentil. ...	2		
(iv) Peas. ...	2		
(e) Oil Seeds. ...	2		
(i) Mustard. ...	2		
(ii) Ground Nut. ...	2		
(iii) Til. ...	2		
(iv) Sunflower. ...	2		

THEORETICAL		PRACTICAL	
Syllabus	No. of Classes	Syllabus	No. of Classes
(f) Sugar Cane.	6		
(g) Soyabean.	2		
(h) Forage Crops.			
(i) Maize.	1		
(ii) Para grass.	2		
(iii) Cowpea.	2		
(iv) Napior.	2		
(v) Borsom and Lucorn.			
5. Crop protection : (53)			
(a) Introduction.	1	(a) Important farm pests.	
(b) Nature of damage due to pests in important crops—		(i) Identification of the insects, diseases and weeds.	8
(i) Insects.	8	(ii) Identification of their damage symptoms.	28
(ii) Diseases.	8		
(c) Methods of control and control measures (both chemical and non-chemical) in important crops.		(b)	
(i) Insects.	8	(i) Identification of Plant protection chemicals.	1

THEORETICAL

Syllabus	No. of Classes
(ii) Diseases.	8
(iii) Weeds.	8
(d) Protection against rodents.	2
(e) Precautions required to handle pesticidal chemicals.	2
6. Irrigation and drainage : (23)	
(a) Introduction.	1
(b) Roll of irrigation and drainage in crop production.	3
(c) Sources and different methods of irrigation.	12
(d) Important methods of drainage.	5
(e) Water requirement of different crops.	2
7. Farming Systems :	
(a) Law of diminishing return in fertilizer use.	1
(b) Balancing of imputs and their package approach.	4

PRACTICAL

Syllabus	No. of Classes
(ii) Computation of Plant protection chemicals.	1
(c) Use of rat control methods.	1
(d) Use of plant protection chemicals including handling of sprayers and dusters.	4

THEORETICAL

Syllabus	No. of Classes
(c) Cost of production of different crops. ...	8
(d) Cost of operating plough, harvester, thresher, pump, power tiller, etc. ...	10
Farming system :	
(e) Concept of mixed, specialised and Subsistance farming. ...	2
(f) Crop rotation. ...	3
(g) Inter-mixed-multiple- and relay-cropping.	2
(h) Special features of rainted and irrigated agriculture. ...	2
(i) Site selection of farms. ...	2
(j) Layout of farm, buildings, roads, irrigation and drainage system. ...	10

PRACTICAL

Syllabus	No. of Classes
(c) Maintenance of farm records and accounts.	5

Horticulture and Fruit and Vegetable Preservation.

	Theory	No. of classes		Practical operation	No. of classes
1. a.	Definition of Horticulture and its different branches. ...	2	a.	Morphological studies of important fruits and vegetables. ...	4
b.	Common fruits and vegetables and their importance in diet. ...	5	b.	Identification and study of the edible parts.	4
2. a.	Classification of fruits & vegetables. ...	3			
b.	Area under common fruits & vegetables. ...	3			
c.	Their distribution in the State and the country. ...	4			
d.	Climatic requirements of the above fruits & vegetables. ...	6			

Theory	No. of classes	Practical operation	No. of classes
3. a. Different methods of propagation of fruit plants.	12	a. Practising different propagation methods : different types—currting, layering and grafting.	9
		b. Practice of propagation in mango, banana, citrus, pineapple and litchi.	3
b. Nursery management of fruit plants.	6	c. Layout of a nursery	2
		d.	
4. a. Selection of site and layout of an orchard.	6	a. Layout of orchard by square system.	4
b. Study of pollination, fruitset and fruit development.	2		
5. Preparation and management of seedbed to raise vegetables and flower seedlings.	8	a. Preparation of seedbed and raising of seedlings of vegetables and flowers.	8
6. Chemical control of pests and diseases—common insecticides and fungicides and their methods of application.	20	a. Working with different types of sprayers and dusters.	4

7.	Study of the following crops in respect of varieties, propagation and cultural requirements (a) Mango, (b) Banana, (c) Citrus, (d) Guava, (e) Litchi, (f) Papaya, (g) Pineapple, (h) Grapes & (i) Apple. ...	42	a. Cultivation of papaya, pineapple and banana. ...	12
			b. Application of the different methods of orchard irrigation and fertilizer application.	6
8.	Study of the following crops in respect of seed rate, raising of seedling and cultural requirements ; (a) Brinjal, (b) Shag, (c) Patal, (d) Kumra, (e) Water melon, (f) Musk melon, (g) Cabbage, (h) Cauliflower, (i) Tomato, (j) Pea, (k) Potato, (j) Lady's finger. ...	50	a. Cultivation of important summer and winter vegetables. ...	80
			b. Raising of seeds of common vegetables ...	8
9.	Study of the following crops in respect of propagation and management : (a) Rose, (b) Dahlia, (c) Winter annuals, (d) Tuberpse, (e) Jesmine. ...	20	a. Cultivation and multiplication of rose, dahlia, tuberose and jesmine. ...	8
			b. Planning and cultivation of the institute of flower garden. ...	18
10.	Common information regarding important hedges, shrubs, climbers and roadside plants. ...	6	a. Growing of hedge plants climbers, shrubs and trees in the institute garden. ...	4

Theory	No. of classes	Practical operation	No. of classes
11. a. Principles of fruit and vegetable preservation. ...	4	a. Preparation of Jam, Jellies, Squash Juice, Chutney, pickles, candy, tomato ketchup.	8
11. b. Methods of preparation of Jam, Jellies, marmalade, squash, juice, tomato, ketchup, pickles morabba. ...	25		
12. a. Method for canning of fruits and vegetables.	6	a. Studying the methods of sterilization. ...	2
b. Spoilage of canned and preserved products.	2	b. Drying of fruits and vegetables. ...	4
c. Location, layout and requirement for small scale preservation unit. ...	10	c. Canning of fruits and vegetables. ...	4
		d. Identification of equipment necessary for a small scale preservation unit. ...	2
13. Quality control, grading, marketing and storing of (a) fruits, (b) vegetables, (c) preserved and processed articles, (d) Flowers etc. ...	18		
	260		194
(Period of 45 minutes each)		(Periods of 3 hrs. each)	

POULTRY FARMING

The duration of curriculum will be for two years (730 days) in the vocationalisation of the Secondary Stage (Class XI and Class XII) for the proposed pattern of 10+2+3.

It is expected that every year about 182 days will be available as working days for institutional studies and training. A period of 30 days will be utilised for field work and training at Farmers end while for evaluation 16 days may be earmarked. Vacation and Sundays may take away 137 days in a year.

Institutions working 6 (six) days a week the total number of Classes available would be 39 periods of 45 minutes duration @ 7 periods per day for Monday to Friday and 4 periods on Saturday. As per schedule III of the curriculum including laboratory practical and field works an institution will arrange for 21 periods in a week for vocational subject out of total periods of 39 as mentioned earlier. In other words there will be 26 weeks for institutional studies in a year which means 546 no. of periods.

The course being a vocational one emphasis should be given on Practical works where the students will learn the different techniques involved in this particular subject by repeated practices. The success will entirely depend on the proportion of personal involvement by the students in acquiring the art and skill of this Science.

Hence these 546 periods may be divided as follows :—

(a) For theoretical Classes = 276 periods of 45 mts. duration. (100 marks).

(b) For practical Classes = 204 periods of 3 hrs. duration. (300 marks).

For Practical Classes each institution must have small incubators of say 100 egg capacity both kerosene and electrical, brooders, brooder cum rearing room of 100 sft. and a deep litter house of 150-180 sft. Besides extra institutional Farm training has been advised in each academic year so that the students can see the

Private Farms/Govt. Farms in rural and urban areas, the functioning of Co-operatives, the marketing arrangements, Transportation and storage of Poultry Products etc.

As guide line to the teachers for preparation of their lesson plan for estimating the number of periods that will be required to cover the syllabus the following schedule has been drawn up.

POULTRY FARMING

	Syllabus	No. of periods (45 min. duration)
1.	Definition of Poultry, Importance of Poultry products in human nutrition.	6
2.	External parts of Poultry. Internal structure of Poultry and their functions : (a) Skeleton of fowl. (b) Gastro-intestinal tract and digestive system of fowl. (c) Reproductive systems of male and female.	20
3.	(a) Formation of egg in the body. (b) Structure of an egg.	12
4.	Standard classes, breeds and varieties of fowls and ducks (American, English, Mediterranean and Asiatic)—Rhode, Island Red, New Hempshire, Ulymouth Rock, Australorp, Orpington, Sussex, Leghorn, Minorca, Brahma, Khaki, Campbell. Indian Runner.	20
5.	Selection and care of hatching eggs : **Hatching :** (a) Natural, ((b) Artificial :— (i) Management of incubators during incubation. (ii) Causes of poor hatches and "dead in the shell".	25

	Syllabus	Number of Classes (each of 3 hours duration)
6.	Brooding and rearing of chicks : (a) Natural, (b) Artificial management of chicks in the brooder.	30
7.	Site for poultry farm, housing of birds and equipment necessary in a poultry house. System of rearing poultry—(a) Free range, (b) Semi-intensive system, (c) Intensive system. (i) Deep litter, (ii) Battery.	45
8.	Principles of poultry feeding. Nutrients their nature and function. Requirements for feeds for different ages and groups of fowl. Range of proportion of various feed ingredients in a poultry ration. Classification and composition of poultry feed ingredients. Elementary evaluation of poultry feeds. Methods of feeding.	50
9.	Common poultry diseases and their control : (a) Ranikhet, (b) Fowl Pox, (c) Coccidiosis, (d) Marek's disease, (e) Parasites.	48
10.	Marketing, storage and transport of eggs.	20
	TOTAL :	276

PRACTICAL OPERATIONS :

No. of periods (3 hrs. duration)

SYLLABUS : PART—A

1. Judging of birds. (2) Selection of feed ingredients—carbohydrates, proteins, fat, vitamins and minerals and antibiotics. (3) Feed requirement, selection and preparation of food for different stocks and feeding time. (4) Housing of birds. (5) Cheap ration. (6) General management of different stock. (7) Gulling of birds. (8) Routine work in poultry farm. (9) Preventive and prohylactic measures against common diseases. (10) Grading of eggs. (11) Preservation and transport of eggs. (12) Vaccines and vaccination of birds. 81

PART—B :

1. Hatching of eggs :—

(a) Natural hatching, (b) Incubators—different types of incubators (electric, kerosine). (2) Different parts of incubators. (3) Working of incubator. (4) Disinfection of incubator. (5) Candling of eggs. (6) Systems of rearing chicks. (7) Special features of feedings chicks. (8) Sexing of birds. (9) Autopsy of birds. (10) General procedure for diagnosis of common poultry diseases.

PART—C :

Production of eggs and birds for table purpose. Economic management of poultry units. Preparation for marketing, Accounting of poultry farm. 42

TOTAL : ... 102

POULTRY FARMING : Theoretical Classes—276 (45 minutes duration)

Practical Classes—204 (3 hours duration).

	Theoretical.			Practical.	
	Syllabus	No. of Classes		Syllabus	No. of Classes
1.	Definition of Poultry. Importance of Poultry products in human nutrition.	6			
2.	External parts of Poultry.	8	2. (a)	Skeleton of fowl.	4
	Internal structure of Poultry and their functions :		(b)	Gastro intestinal tract and digestive system of fowl.	6
	(a) Skeleton of fowl.	2	(c)	Reproductive system Female Reproductive system	5
	(b) Gastro-intestinal tract and digestive system of fowl.	4			
	(c) Reproductive systems of male and female.	6			
3.	(a) Formation of egg in the body.	6	3. (a)	Formation of egg in the body.	2
	(b) Structure of an egg.	6	(b)	Structure of an egg.	6

Theoretical

	Syllabus	No. of Classes
4.	Standard classes, breeds and varieties of fowl and ducks (American, English, Mediterranean and Asiatic)—Rhode Island Red, New Hampshire, Plymouth Rock, Australorp, Sussex, Leghorn, Minorea, Khaki Campbell, Indian Runner.	20
5.	Selection and care of hatching eggs :	
	Hatching :	
	(a) Natural	4
	(b) Artificial	8
	(i) Management of incubators during incubation.	8
	(ii) Causes of poor hatches and "dead in the shell."	5

Practical

	Syllabus	No. of Classes
4.	Breeds of fowls and their utility with breed characteristic :	2
	(i) While Leghorn	4
	(ii) Rhode Island Red	4
	(iii) Deshi	2
	(iv) Khaki Campbell Duck	4
	(v) Deshi duck	
5.	Selection and care of hatching egg :	
	(i) Hatching eggs what are they?	2
	(ii) Candling, care and storage of hatching eggs.	4
	(iii) Natural hatching.	2
	(iv) Incubators and their parts.	6
	(v) Disinfection of incubators.	4
	(vi) Working of incubators.	4
	(vii) Management of hatchery.	4

Theoretical

	Syllabus	No. of Ciasses
6.	Breeding and rearing of chicks :	
	(a) Natural ...	5
	(b) Artificial management of chicks in brooder ...	25
7.	Site for Poultry Farm ...	5
	Housing of Birds ...	8
	Equipment necessary in a Poultry House	5
	System of rearing poultry ...	3
	(a) Free range ...	4
	(b) Semi-intensive system ...	8
	(c) Intensive system	
	(i) Deep litter ...	8
	(ii) Battery ...	4

Practical

	Syllabus	No. of Classes
6.	Breeding and Rearing of chicks :	
	(i) Natural rearing ...	3
	(ii) Artificial rearing ...	6
	(iii) Brooders and parts of brooders ...	6
	(iv) Brooder house managements ...	6
	(v) Brooder house equipments like chick feeders, waterers ...	4
	(vi) Sexing of chicks ...	4
	(vii) Identification by toe-punching and using badges/bands ...	4
7.	Housing of birds and equipments :	
	(i) Different types of houses. ...	4
	(ii) Different Poultry house equipments ...	6
	(iii) Cutting of birds in different ages. ...	4

Theoretical

Syllabus	No. of Classes
8. (a) Principles of poultry feeding. ...	5
(b) Nutrients—their nature and function. ...	10
(c) Requirements for feeds for different ages and groups of fowl. ...	10
(d) Range of production of various feed ingredients in a poultry ration. ...	6
(e) Classification and composition of poultry feed ingredients. ...	6
(f) Elementary evaluation of poultry feeds. ...	8
(g) Methods of feeding. ...	5
9. Common poultry diseases and their control :	
(a) Ranikhet ...	10
(b) Fowl Pox ...	10
(c) Coccidiosis ...	10
(d) Marek's disease ...	8
(e) Parasites ...	10

Practical

Syllabus	No. of Classes
8. Poultry feeding and nutrients :	
(i) Types of feed and methods of feeding.	10
(ii) Identification of common poultry feed ingredients and their nutritive value.	10
(iii) Selection and preparation of feed for different ages and different types of breeds, including broilers. ...	10
9. Common Poultry diseases and their control :	
(i) Autopsy of birds. ...	10
Post Mortem lessons of common poultry diseases.	
(ii) Identification of primary lessons and	
(iii) Medicines and types of medication....	4
(iv) Storage, preparation and usage of vaccines. ...	6

Theoretical		Practical	
Syllabus	No. of Classes	Syllabus	No. of Classes
10. Marketing ...	8	10. Marketing, storage and transportation of eggs :	
Storage ...	8	(i) Judging quality of an egg. ...	6
Transport of eggs ...	4	(ii) Grades and grading of eggs. ...	4
		(iii) Preservation of eggs. ...	5
		(iv) Packing and Transportation of eggs.	6
		(v) Different usage and types of cooking of eggs. ...	4
		(vi) Preparation of birds of slaughter including broilers. ...	6
		(vii) Types of killing and dressing of birds.	4
		(viii) Storage and transportation of meat. ...	4
		(ix) Utilisation of byproducts. ...	3
	276		204

PISCICULTURE

Theory

Syllabus	Number of classes (each of 45 minutes duration)
1. Economics of Important food fishes, Prawns and Frog. ...	2
(a) Indian major carps (Catla, Rohu, Mrigal and Calbasu) ...	2
(b) Important cat fishes ...	1
(c) Air breathing or live fishes (Singhi, Magur, Koi and Sol) ...	2
(d) Exotic carps (Silver, Grass and Common carps) ...	2
(e) Migratory fishes (Hilsa and eel) ...	2
(f) Prawns and crabs ...	1
(g) Frog ...	1
TOTAL ...	13
2. Principles of Pisciculture ...	2
(a) Seed Production (Natural Collection and induced breeding) ...	8
(b) Bundh breeding of Indian major carps. ...	2
(c) Seed handling and transport ...	2
(d) Kinds of ponds and their management, Pond construction techniques and methods of soil and out analysis. ...	2
(e) Manuring operation with organic and inorganic manures. ...	2
(f) Natural and supplementary feeding, Food chain and Pond productivity. ...	4
(g) Composite fish culture—species combination, their stocking rate and ratio. ...	6

	Syllabus	Number of Classes (each of 45 minutes duration)
(h)	Artificial fees and nutrition. ...	2
(i)	Care and diseases of fish in composite fish culture. ...	2
(j)	Brackish water fish farming. ...	2
(k)	Harvesting and economics of fish culture. ...	2
(l)	Coastal fisheries. ...	1
	TOTAL ...	37
3.	Pond weeds and their control. ...	1
(a)	Different types of aquatic weeds.	
(b)	Floating, emergent, submerged and marginal.	2
(c)	Algal blooms. ...	1
	TOTAL ...	4
4.	Fish enemies—Predatory fishes and aquatic insects. ...	2
(a)	Fish diseases and their control ...	2
(b)	External and Internal parasites of fishes. ...	2
	TOTAL ...	6
5.	Air-breathing fishes and their culture. ...	2
(a)	Paddy-cum-fish culture ...	1
(b)	Short term culture of fishes. ...	2
(c)	Use of pesticides and water pollution. ...	4
	TOTAL ...	9

Syllabus		Number of Classes (each of 45 minutes duration)
.	Fish preservation and Marketing	1
(a)	Icing and Freezing. ...	2
(b)	Drying, salting, smoking and canning. ...	6
	TOTAL ...	9
7.	Water chemistry and fish culture. ...	2
	TOTAL ...	2
	GRAND TOTAL	80 Classes.

PISCICULTURE PRACTICALS

	Syllabus	Number of classes (each of 3 hours duration)
1.	Determination of H, temperature, dissolved oxygen and free carbon dioxide of water.	2
2.	Acquaintance with natural and supplementary food of fishes used for culture in ponds.	4
3.	Estimation of the surface area and volume of a pond and calculation of doses of manure.	2
4.	Volumetric estimation of plankton population in ponds.	4
5.	Volumetric estimation of bottom dwelling organisms of ponds.	2
	TOTAL :	14

Part—B

1.	Identification of important species of fish, prawn, frog, aquatic weeds, predatory fishes and aquatic insects.	8
2.	Identification of important species of brackishwater fishes.	1
3.	Identification of fry of catla. rohu, mrigal, calbasu, bats and singhi.	4
4.	Identification of mature male and female rohu, catla, mrigal and common carp.	2
5.	Studies of food and feeding habits of fishes (rohu, catla, lata, koi and boal)	4

	Syllabus	Number of Classes (each of 3 hours duration)
6.	Dissection of pituitary gland from fish and their preservation.	4
7.	Preparation of pituitary gland extract and induced breeding practices.	6
8.	Visit to bundh breeding centre. ...	1
9.	Acquaintance with different cultural operations of fish farms.	8
	TOTAL : ...	38

Part—C

Fish farm management, production units, fishing techniques, grading, storage, transport, marketing, fish farms records, cost and return accounts.	10
TOTAL : ...	10
GRAND TOTAL : ...	62

MECHANICAL TRADE. BASIC THEORY :

Contents in the Syllabus.	Break up of Content	Suggested Periods.	Suggested References	Page Nos.
A. Materials and Processes. Mechanical Properties and engineering uses and specifications of common engineering materials such as cast iron, different kinds of steel and their alloys, high speed steel, cemented Carbide, non-ferrous materials and alloys. Belt, liner and gasket materials.	(*i*) Characteristics of metals. Alloys, Ferrous alloys, Steel alloys, Chromium Steel, nickel steel, nickel-chromium steel, manganese steel, molybdenum steel, tungsten steel, vanadium steel. High speed steel, cemented carbide, bright steel, stainless steel, composition, mechanical properties and uses of the above materials.	5	1. Workshop Practice Mokherjee & Das. NCERT. A text book for Technical Schools. 2. Workshop Technology Vol.-I. Hazra Chowdhury. 3. Workshop processes and materials. Vol. I J. Schofield. Blackie	263-267 19-45 12-22
	(*ii*) Composition, properties and uses of cast iron, wrought iron.	2		
	(*iii*) Composition, properties and uses of non-ferrous alloys: aluminium alloy, bronzes, brass, soft solder, bearing metals,			

Contents in the Syllabus.	Break up of Content	Suggested Periods.	Suggested References	Page Nos.
	pewter, monel metal, german silver, silver alloy, gold alloy.			
	(*iv*) Belt, liner and gasket materials.	2	4. Workshop Technology Vol.-II. Hazra Chowdhury. 1.	1-31 183-217
B. Hand Tools Uses of steel rule, calipers, try-square, hammers, files, chisels, vices etc.	(*i*) Classification of tools, general characteristics of hard tools; fitting tools, bench vice, machine vice, hand vice, pin vice, C-clamp, tool maker's clamp; striking tools, ball peen hammer, straight and crossed peen hammer, planishing hammer, double-faced hammer, soft hammer, sledge hammer; cutting tools, classification of cutting tools, chisel, flat chisel, cross-cut chisel, diamond-point chisel, round-nose chisel, hot and cold chisel. Hammering operation, operation of a chisel (chipping) (*ii*) File, parts and type of files, operation with a file (filing); filing methods, cross-	3	5. Teach yourself Mechanical engineering Vol.-1 (Hand tools) E. Peatfield. Practical Books. 6. Workshop practice and Shop Talk-1 Technical Teachers' Training Instiute, Calcutta.	 61-72

3

filing, draw filing; testing of filed surface, filing of hard and soft metals, care and maintenances of files. Scrapers and operation with a scraper; shears; saws, specification, hand hacksaw, powersaw, bandsaw.

Threads and threading tools; specification of threads, tools for threading, taps, dies, operation with taps & dies. Screw drivers, different types and their uses; wrenches and spanners, different types and their uses. 4

(*ii*) Marking and measuring tools; surface plate, angle plate, V-blocks, scriber, punches, chntre punch, prick punch, dividers, trammel, callipers, hermaphrodite callipers; steel rule, try-square, vernier callipers, bevel protractor, combination square set, surface, gauge, vernier depth and height gauges, micrometer-inside and outside.

Contents in the Syllabus.	Break up of Contents	Suggested Periods.	Suggested References	Page Nos.
C. Elementary Processes. Moulding and casting, forging, soldering, brazing, welding, machining, rivetting.	(*i*) Moulding and casting: Introduction, foundry metals and their sources, requirements for production of sound castings, foundryequipment, tools & accessories; foundry materials, sand, refractory, materials, fluxes, fuels, metallic materials; moulding technique and operations, cupola and its operation. Defects in castings—reasons and remedies.	4	1.	99-137
	(*ii*) Forging: Introduction, equipment, tools and accesories, types of forging; hearth, anvil, hammers, tongs, chisels, swages, fullers, flatters, punch, drift, poker, rake, swage block. Forging operations, upsetting, drawing down, bending, punching, cutting out, forge welding, heat treatment of forgings.	4	1. 6.	138-161 37-45
	(*iii*) Welding, soldering, brazing: Welding and welding processes, Electric arc welding and gas welding, equipment, tools, and accessories, precautions in welding. Welding methods;		1. 6.	162-182 84-91

	types of joints, edge preparation, common defects in welded joints. Flame cutting, Electrodes and fluxes. Soldering, brazing.	5		
	(*iv*) Machining: Metal cutting, different types—orthogonal and oblique cutting, cutting tools, cutting tool angles. Machine tools and their classifications, lathe, different parts of a lathe, job holding devices, tools, different operations. Shaping, planing and slotting Machine tools—different parts and operations; Drills and drilling machines—different parts and operations. Lubricants and cutting fluids.	9	1. 3. 8. 7. Basic engineering craft course. Workshop theory. (Mechanical) R. L. Timings. Longmans.	219-250 152-200
	(*v*) Rivetting: Rivets—different types, rivetted joints, methods of rivetting, caulking and fullering.	2	2.	161-165
D. Mechanism. Displacement, speed, velocity, aceleration of sliding and rotating bodies and their graphical re-	(*i*) Vector and scalar quantities, addition and subtraction of vectors, displacement, velocity, accleration. Relation between displacement, velocity,	6	8. Applied Mechanics. J. D. Walker. English Univ. Press. 9. General Enginering Science.	1-13 52-59

Contents in the Syllabus.	Break up of Contents	Suggested Periods.	Suggested References	Page Nos.
presentation. Driver and follower, linkages, straight-line and slider crank mechanism. Transmission of motion by direct contact. Transmission of motion by belts, ropes, chains, gears, gear trains, cams, motion of ned and screw. Journal and bearing, slides and guides, Different types of belts, gears, cams and cam followers.	acceleration and time, velocity-time diagrans, motion of falling bodies. Angular displacement, velocity and accleration.		Besanko & Jenkins Oxford Univ. Press.	
	(*ii*) Slider-crank mechanism, Rocker-arm mechanism; cam mechanism.	4	10. Fundamentals of engineering mechanics. L. Levinson Peace Pub. Moscow.	265-278
	(*iii*) Power transmission: Belt drive; Rope drive: chain drive; Gear drive. Worm and worm wheel transmission.	6	11. Mechanical Technology & Engineering Primer. A. Deb. Niraj Prakashan.	57-76 25-29
E. Simple Machines. Levers, inclined plane; screw jack, wheel & axle, pulley blocks and winch.	Velocity ratio, mechanical advantage and efficiency of a machine; Law of a machine, lever, inclined plane, wheel and axle, windlass, capstan, crab and winch, snatch block, pulley blocks, screw jack.	6	1. 10. 12. Applied Mechanics for beginners. D. C. Das.	19-25, 29-31 88-98 113-131

CIVIL ENGINEERING—BASIC THEORY

Courses	No. of Periods	Notes on Teaching
A. Materials and Processes		
1. Cement	2	Types—Ref. Book A, page 106 ; Uses—Ref. Book A, page 108 ; Setting and Hardening—Definition only ; Field test—Soundness test etc. ; Storing : Ref. Book A, page 107 ; Coloured Cement : Ref. Book A, page 106 ; Ref. Book A, page 96, 99 above.
2. Lime	2	Sources—Ref. Book A, page 83 ; Classification—Ref. Book A, page 83, 85 ; Slaking—Ref. Book A, page 90 ; Use—Ref. Book A, page 95, 96 ; Setting—Ref. Book A, page 84. Characteristics of good lime—Plaster of Paris—Composition—It is this hemi-hydrate, $2CaSO_4H_2O$ made by igniting gypsum to 120°C. When plaster of Paris is made into a paste with water it rapidly sets and hardens undergoing a slight expansion in the process. Use—Plaster of Paris is used for taking casts, as the slight expansion on setting ensures accurate reproduction of details ; and as a surface for wal's and ceilings. **Plaster of Paris casts are used for decorative false ceilings.**

Courses	No. of Periods	Notes on Teaching
3. Bricks	2	Classification/Characteristics use—Ref. Book A, page 59-60.
4. Stones	2	Sources—Formation of Rock-Igneous Rock (Granite, Quarzite, Trap, Basalt etc.). Sedimentary Rock (Sand stone, Lime Stone, etc.), Metamorphic Rock (Marble, Slate), Composition—Ref. Book A, page 4 ; Classification—Ref. Book A, page 2 ; Common varieties in use : Ref. Book A, page 5 .
5. Tiles	1	Different varieties in use : Ref. Book A, page 69-73.
6. Sand & Soorkey	2	Sand—Sources, Classification, Specification and Use, Bulking of sand—Ref. Book A, page 110-113. Soorkey—Sources, Classification, Specification, Use, Manufacture—Ref. Book A, page 114-115.
7. Timber	2	Varieties, uses, defects, seasoning, diseases and preservation, characteristics of good timber, different market forms—Ref. Book A, page 162-178. Plywood and Veneering—Ref. Book A, page 182-183.
8. Mortar	2	Uses, preparation of cement and lime mortar. Ref. Book A, page 114-117.
9. Lime Concrete	2	Composition, preparation, testing and use—Ref. Book A, page 129.
10. Cement Concrete	3	Composition : Ref. Book A, page 129 ; Preparation : Ref. Book A, page 137 ; Placing and Compaction—Ref. Book A, page 139-140.

		Curing—Ref. Book A, page 147. Grading of aggregates—Ref. Book A, page 133-135. Reinforced Concrete—Ref. Book A, page 151.
11. Paints, Varnishing & Polishing	2	Paints—Ingredients and characteristics of good oil paint, Preparation and application to wood and steel works, enamel painting—Ref. Book A, page 248-257. Varnishing : Ref. Book A, page 259. Polishing : Ref. Book A, page 260.
12. Iron	2	Composition and uses of Pig Iron : Ref. Book A, page 197. Cast Iron : Ref. Book A, page 200. Steel : Ref. Book A, page 213 (Composition). Steel : Ref. Book A, page 227 (Use).
13. Bituminous material	3	Bituminous materials and their functions of Asphalt, Bitumen, cut back, emulsion—Ref. Book A, page 274. Road tar—Ref. Book A, page 276.
14. Materials used in sanitary & plumbing	4	Use of the following materials with working specification in Sanitary and plumbing installations :— Copper, Brass, Lead, Galvanized Iron, Galvanized steel, C.L., P.V.C., Vitre-

Courses	No. of Periods	Notes on Teaching
		ous china, Stoneware, Rubber and other gasket material, asbestos cement—Ref : specification and schedule for sanitary and plumbing works of the P.W.D.

Reference Books :—

1. Book 'A'—Engineering Materials by K. P. Roy Chowdhury (Published by Oxford IBH Publishing Co).
   Teacher may consult the following books also :
2. Engineering/Building Materials by N. Chowdhury.
3. Building Materials by Surinder Singh.
4. Modern Building Materials by M. A. Shate.
5. Engineering Materials by Leigue.

B. Sketching and Reading of Drawings :

Topics	No. of periods	Notes and Reference Books :
1. Brick Bonding ...	4	1. Civil Engineering Drawing and Design by D. N. Ghose (Publisher : Rakamari Book House).
2. Pian, Elev. etc. of small building ...	8	2. Prathamik Engineering Drawing by Hemanta Kumar Bhattacharyya.
3. Simple R C.C. detail and Section of W.B.M. road ...	8	

C. Advance drawings :

4. Steel columns and truss ...	5	
5. Fittings etc. in internal sanitary and Plumbing system ...	5	
6. Septic tank, Muster trap with Public sewer	5	
7. Sanitary installation of a residential building	5	
8. Water supply system ...	4	

D. Elements of Surveying :

1. Preliminary and chain survey. Basic concept. Distance measuring devices ...	8	Objects and Principles of Surveying Instruments. Linear Measuring Instruments, viz. Pegs, Flags, coloured rods, chains and arrows, Tapes, Offset rods, steel-band, steel tape etc. Other instruments like Optical square etc. as level.
Use of chains in tapes and other e.g. Chain surveying equipments.		To check the length of a chain and tape and how to use the chain properly. Ranging a line, fixing the arrows. Unfolding and Folding the chain Erros in Chaining (in short). Definition, when the chain survey is recommended.
2. Levelling, General discussion, Bench mark and accessories used. ...	8	Instruments used. Principle of chain survey. Preliminary operations, Station points, North line, points in making the Triangulations.

Topics	No. of periods	Notes and Reference Books
		Measuring the line, Oblique offset. Instruments for taking offset. Method of plotting in chain survey. Definition. Function of level instrument and parts of the instrument.
		Accessories for levelling operation, viz. staff etc. Dumpy level, Temporary adjustment of this level. Bench mark, Reduced level, Datum, Precautions to be taken before and during the use of level and levelling.
3. Use of dumpy level. Computation of level and plotting ... Internal evaluation and tutorial ...	20	Use of level book. Rise and fall method. Recording Back sight, Inter sight, Foresight reading and distance. Calculations of R-L. and mathematical check. Plotting of levels along road alignment and showing its longitudinal section (simple drawing).

Reference Books:

1. Survey by C. L. Kochher.

MECHANICAL SERVICING AND MAINTENANCE THEORY

Contents in the Syllabus.	Break up of Contents	Suggested Periods	Suggested References	Page Nos.
1. Elementary knowledge of manufacturing Processes: Moulding and Casting, Forging and casting, Rolling and Drawing, Dishing and Pressing, Brazing and Soldering.	(*i*) The Shaping of metals: Casting, forging, cold-working.	2	1. Workshop Processes Vol. I & II	15-25(I)
	(*ii*) Casting of metals: Sand Casting, Steel casting, die casting, centrifugal casting.	5	R. T. Pritchard. ELBS-Lowpriced Text.	1-19(II)
	(*iii*) Forging of metals: Hand forging, drop forging; Extrusion; Brazing and soldering.	5		21-39 (II) 49-58 (I)
	(*iv*) Drawing or cupping, metal spinning; press, press operations and tools.	4	2. Manufacturing Processes. M. L. Begeman. Asia Publ. House	2-6; 9-60; 219-221; 258-259; 268-270; 283; 298-305
2. Welding Processes: Oxyacetylene and Electric arc welding; Flame Cutting.	Welding and welding pro-	12	2. 3. Workshop Technology Vol-I B. S. Baghuwanshi. 4. ISI Handbook of Manual Metal-arc Welding.	182-219 467-482

Contents in the Syllabus.	Break up of Contents	Suggested Periods.	Suggested References	Page Nos.
3. Basic Tools, Saw, Drill, Tap, Die, Pipedie, Pipe wrench, Reamer, Broach, Lathe tools, Use and care of tools.	(*i*) Hack Saw, Drill, Taps and dies, Socket wrench, Allen wrench, pipe wrench, pipe cutter chain pipe tongs.	4	5. Shop Theory. H. Ford Trade School.	16-19; 53-66; 72-91; 7-8
	(*ii*) Reamer, Broach, Lathe tools.	4	2. 1. 5.	473-475; 553-555, 562-567 147-149 (II) 146-160(I) 106-109
	(*iii*) Care of tools:	2	6. Shop Tools care and repair. D. Hunt. Aff. East-West Press. 6. Engineering Workshop Practice. L. J. Merry.	22-25; 42-46; 57-63; 18-82; 127-132; 15-16.
4. Lathe: Description, working mechanism, tools, different operations.	(*i*) Requirements of a lathe, main items for identification e.g. height of centres, distance between centres, surfacing, sliding, screw cutting, hollow spindle; different parts; work holding devices, Tool setting, spindle speeds, and feeds;	4	1.	122-144(I)

	(*ii*) Cutting tools; tool wear, cutting fluids., *Two-setting jobs.*, different operations.	8		122-138 (II) 159-181(II)
5. Drilling machines and operations.	Geometry of a drilling machine, types of drilling machines, different parts, types of drills, work holding devices, drilling techniques.	5	1.	164-183(I) 139-158(II)
6. Lubricants.— Selection of types, method of application.	Purpose of lubrication, types of lubricants, properties of lubricants, Selection and methods of application	4	7. Elements of work shop Technology Vol-I Hazra Chowdhury.	99-106
			6.	125-126
7. Cutting fluids; types and applications.	Cutting fluids—types and applications.	2	7.	99-106
			1.	134-136(II)
			2.	361-363
8. Selection of cutting speed, feed, depth of cut and cutting fluids for different operations.	Cutting speed and feed: Shaper, drils, lathe, milling, grinder; cutting fluids for different operations.	5	5.	60-61
				133-145
			2.	195-196
				248
			2.	363-364
			7. Vol II	174-175
			3. Vol. II	451-453
			8. Machine Tool operation. Vol -2.	

Contents in the Syllabus.	Break up of Contents	Suggested Periods.	Suggested References	Page Nos.
			Burghardt. Mcgraw-hill. student edition	627-640
9. Jigs and Fixtures and their uses.	Jigs and fixtures; *principles of design* and location, different types and uses.	5 5	7. Vol. II 9. Workshop Technology. III W. A. J. Chapman. ELBS-Lowpriced texts.	505-523 348-382
10. Shaping, Milling and grinding machines—description, working principle and uses.	(*i*) Shaping machine: Classification, different parts, mechanism, cutting speed, tools and tool holding devises.	5	1. 2. 5.	185-213(I) 440-454 110-121
	(*ii*) Milling machine: Milling principle, classification and types of milling machines, milling cutters, tool holding devices, milling techniques.	8	1. 2. 5.	183-205(II) 487-510 162-196
	(*iii*) Grinding machines: Abrasives, grinding wheels, Grinding machines, classification of grinding machines—principle of working and uses.	5	2.	569-600
11. Measuring and Inspection Instrument—Surface plate, Try-square,	Inspection, types of fits, tolerance and allowance. Measuring Instrument, classi-		2. 5.	313-348 197-213

Dial indicator, Micrometer, Height gauge, Vernier, Plug, Snap and ving gauges.	-fication of measuring instruments; Linear measurements, role, micrometer, vernier caliper, depth gauge, height gauge, telescopic gauges, combination square. Angular measurement, adjustable bevel, bevel protractor, sine bar, angle gauge blocks. Plane-surface measurements, straight edge, surface gauge. Classification of gauges: Plug gauge, ring gauge, snap gauge Dial indicator, feeler gauge.	12		32-52
12. Heat Treatment and its equipments.	Heat treatment: Importance of cooling rate on grainsize, grain size and strength, effect of heat on steel structures, stress relieving. Hardening, Annealing, Normalising, Tempering. Iron-Carbon diagram and its use. Carborising, superficial hardening, pack hardening, Furnaces-gas, oil, electric; temperature measuring devices, mercury thermometer, pyrometer, segar cones.	8	1. 2. 5. 7.	58-81 (II) 123-143 214-230 66-88

Contents in the Syllabus.	Break up of Contents	Suggested Periods.	Suggested References	Page Nos.
	Nitriding, Induction hardening, Flame hardening.			
13. Preventive and Running maintenance.	Preventive maintenance and management of maintenance. Trouble shooting. Gear and bearing failure. Machine tool lubrication. Replacement and repair of parts. Realigning machine tools. Maintenance of tools, tool handles, grinding equipment and general machine maintenance	15	10. Machine tool main- 10. tenance & Rebuilding Porritt & Litton. Machinery Publishing Co. 6. 9.	11-19 32-44 45-59 60-71 121-141 142-166 1-56 85-94 113-124
14. Erection of new machines, Foundation of machines, Testing of alignments.	Unloading, lifting, use of ramp, horizontal movement, jacks; Foundations, levelling and aligning, grouting. Acceptance tests	10	Vol II	518-536 505-518 111-117 178-182 542-550
15. Safety measures and safety devices.	Safety in the machine shop: milling, shaping, turning, boring, grinding. *Housekeeping*.	6	8. Vol-I 5. 11. Management D. C. Das	23-35 19, 238, 274, 282, 287, 186-191

Mechanical Servicing and Maintenance

Practical

Periods—420

Contents in the Syllabus.	Break up of Exercises	Suggested Classes	Suggested References.
A. Wood work and Pattern making. 1. Use of wood working machines.	1. Study of different parts, drive, principle of operation, use, care and precautions in respect of the following machines. A writeup with a neat sketch is to be submitted.	6(3p) (6 Classes of 3p each.)	1. Workshop Practice. Mokherjee & Das. NCERT Pub. Page 69
2. Wood turning.			2. Woods and wood Working. D. W. Olson Prentice-Hall India Page 58
3. Pattern making from drawings, allowances for Shrinkage, finishing, caniber, rapping draft etc.	(*a*) Circular Saw. (*b*) Band Saw. (*c*) Fret Saw./Jig-Saw (*d*) Wood turning lathe (*e*) Drilling machine. (*f*) Planer-surfacer.		
4. Use of core and core box	2. Wood turnning. (*a*) Face plate turning (*b*) Spindle turning.	2(3p) (2 Classes of 3p each.)	
	3. Making pattern for c. **V-block.**		**1. Page 90-97**

Contents in the Syllabus.	Break up of Exercises	Suggested Classes	Suggested References.
	4. Making Pattern for a link 5. Making pattern for a spur gear blank. 6. Making pattern for an anvil base. 7. Making pattern for a shoulder bushing. 8. Making pattern for a bearing bracket.	8(3p) 8(4p)	3. Exploring Pattern-making and Foundry. H. D. Miner. Affiliated East-West Press.
B. Foundry operation 1. Preparation of sand moulds from patterns.	1. Preparation of sand moulds of the patterns made in Sl. Nos. 3 to 8 above under A.	10(3p) 5(4p)	
2. Metal Casting	2. Metal casting of 2 to 3 items under (1)		
C. Soldering, Brazing, welding operations. 1. Gas welding. 2. Electric welding. 3. Forge Welding.	Preparation of end plates. 1. Gas welding practice. 2. Welding of a butt joint by Leftward gas welding. 3. Welding of a butt joint by Rightward gass-welding.	4(3p)	4. Workshop practice & shop talk 1 TTTI. Publication pp 97-101 5. Welding and Fabrication. E. Wilkinson. Pitman. pp 6-22
4. Flame cutting.	4. Electric-arc welding Practice.		4. pp 92-97

5. Soldering and brazing. work.	5. Welding of double fillet lap-joint. 6. Welding of double fillet T-joint. 7. Welding of double-V butt joint			
	8. Marking a door ring with hook by forge welding.	6(3p) 5(4p)	4.	Pages 55-57
	9. Flame Cutting.			
	10. Soldering of electric wires; pipes.		5.	Pages 78-80
	11. Joining band saw blade by brazing.		4.	Pages 101-103
D. Heat treatment				
1. Normalizing 2. Quenching 3. Annealing. 4. Tempering of Tool Steel.	1. Study of different types of furnaces, various parts, principle of operation, temperature measuring devices. A write-up with neat sketches is to be Submitted.			
5. Quenching media and purposes.	2. To find the effect of the increase of percentage of carbon on the hardness of plain carbon steel; to find the effect of quenching these steels in various quenching media.	8(3p) 3(4p)	6. Workshop experiments of Mechanical Technicians. Hargreaves & Ryall.	

Contents in the Syllabus.	Break up of Exercises	Suggested Classes	Suggested References.
	3. To produce surface hardness on a low-carbon plain steel.		Macdonald. Pages 37-40; 17-18
	4. To investigate the effects of Varying hardening temperature on the structure and properties of high carbon Steel.		7. Engineering Work-Shop Experiments.
	5. Heat treatment of a plug gauge.		H. W. Reece. Pages 16-17; & B. I. Publication. 20-26 &
	6. Case hardening of mandrels.		4. 43-44
	7. Heat treatment of a flat Chisel.		
E. Fitting Shop Practice			
1. Uses of hand tools, hammer, vices, chisels, files. Different types of spanners.	1. Making a simple plate gauge. (go not go type) 2. Making a profile gauge e.g. for a tool handle, such as file.	12(3p)	6.
2. Marking locations for dimensions, holes, grooves, etc.	3. Scraping and bedding of Surfaces.	8(4p)	7. 4.
3. Use of vernier caliper, scales, micrometers, depth gauge, height gauge, Thread gauge etc.	4. Marking out, drilling, spot facing, counterboring and checking of hole centres.		

4. Chipping, filing. and sawing. 5. Use of drill, grinder etc. 6. Use of pipe fitters tools.	5. Making a pipe correction/1 assembly		
F. Standardisation. and fits. 1. Making different types of fits. 2. Use of Standard threads 3. Limits and tolerances.	1. Limits & fits: limits, tolerance and allowance, unilateral and bilateral tolerance. Classes of fit, hole basis system, shaft basis system: gauges (shoptalk) 2. Measurement of types of fit. 3. Estimation of tolerances for a metric thread for a given class of thread fit.	5(3p)	8. Basic Engineering craft course. Workshop theory (mechanical) R. L. Timings. Longmans. Page 35 9. Westermann Tables. Revised to Indian Standards. H. Jutz & E. Scharkus. Wiley Eastern Ltd. Page 77 6. Page 65 10. Fits, Tolerances and Engg. Measurements. Y. Tarasevich & E. yavoish. Peace Pub. Moscow. 81
6. Turning Metal Components. 1. Grinding of Simple turning tools.	1. Grinding of a Single-point turning tool and a boring tool. 2. Plain turning; facing and		6. Page 19

Contents in the Syllabus.	Break up of Exercises	Suggested Classes	Suggested References.
2. Making Simple turning jobs.	longitudinal turning.		11. All about Machine Tools, Gerling & Heller
3. Making taper turning.			
4. Using of Kneeling tools	3. Step turning	12(4p)	18(3p) Willey Eastern. 13.
5. Thread tools and thread cutting operation.	4. Turning, drilling, boring		12. Turning.
6. Drilling by using tail-stock.	5. Taper turning, Knurling		CSTRI, Calcutta, Dasnagar, Howrah. Pages 5, 9, 15, 19, 33
7. Simple boring	6. External thread cutting. 7. Internal thread cutting.		6. Pages 49-63
H. 1. Assembly and disassembly of simple machine parts. 2. Preventive maintenance practice.	1. Dismantling and boxing up of: Lathe Components. Shaper components. Drilling machine components. Gear box., pumps, petrol engine. Diesel engine, compressor. (Scrap equipment can be used for this purpose) 2. Preventive & running maintenance. (For the machines in the School).	7(3p) 3(4p)	

FARM EQUIPMENT AND MAINTENANCE THEORY

Agricultural Equipment—Recommended Reference Book—FARM MACHINERY—by Archie A. Stone.

Pages

1. History of development of Farm Machinery and Equipment. Conventional Indian plows—bullock driven—Harrows, planks etc. Need for improved cultivation methods.

2. Description and use of primary Tillage implements —M. B. Plough, Disc Plows etc. ... 1— 20

   Walking plough, Tractor plough—Repair of ploughs, Field troubles. ... 51— 64

3. Description and use of Secondary tillage implements, Harrows, Cultivator's Harrows—Spike tooth Harrow—its construction and repair ... 65— 74

   Disc Harrows ... ... 74— 80

   Repairing of Disc Harrow ... ... 89— 95

   Cultivators, types and sizes Hoes, ... 172—186

   Tractor cultivator ... ... 191—195

   Weeders ... ... 206—207

4. Description and use of irrigation. See—Under irrigation pumps.

5. Plant protection equipment. Sprayer and duster (hand and power driven).

6. Threshing machines, paddy and wheat threshers, Threshers, construction and principal parts ... 300—319

   Repairs, operation and trouble in threshing machines ... ... 319—329

7. Storage, bins and hoppers.

Farm Power System

1. Classification of tractors, tillers etc. ... 371—378

2-15 Classification of Engines to Preventive maintenance 379-576

Irrigation, Pumps.

(4) Description & use of irrigation machinery, pump sets and other water lifting devices.

1 to 6. Types of pump to

Trouble shooting—Causes and remedies.

Farm Equipment—Servicing and Maintenance

Practical

A, B and C of this subject is the same as A, B and C of Automobile Servicing and maintenance and should be typed from above Sections attached hereto Sections D. E. F and H below comprise of farm machinery farm power system and Stationary system, power tillar for practice of topics under these sections and irrigation pumps. The instructor should show every batch of students how to dismantle wash, clean and refit each of the farm equipment under these sections.

Exercises: After demonstration :

Each batch of students (working in batches of 3 to 5) should be made to strip or dismantle each of the following farm equipment, clean them. Thereafter they should study each part and reassemble them.

D. Tillage machinery, pumps, spraying equipment, thrashing machines.

E. Tractors and power tillers including sub-assemblies such as Carburettors, clutch, gear box, wheels and tyres etc.

F. Stationery engines including fuel injection system, cooling system, lubrication etc.

G. (1) After re-assembling or refitting the above machinery they should be run and tested under field operating conditions.

(2) They should also be taught to service the equipment specially those under E, F and H according to Exercise 19 under automotive Servicing and maintenance (guide lines).

H. Pumps single and multistage. Study their design and construction, clean and re-erect them.

The students should work in batches of 3 to 5 in a batch and each batch should complete exercises (normally 19) under D, E, F and H above.

AUTOMOBILE SERVICING AND MAINTENANCE

Practical

A. Fitting Shop Practice :

1. The instructor should make the students familiar with normal hand tools used in fitting such as :

(a) Hammer of different types ball pene, cross pene etc.
(b) Chisels such as straight, cross, round nosed and diamond point.
(c) Files of different types such as rough, second cut, smooth, flat, half round, round, triangular, square etc.
(d) Snaper straight, round etc.
(e) Hack saw and
(f) Fitters Vise.

Their uses and proper method of using them should also be explained and demonstrated. Students should be asked to repeat them.

2. The instructor should demonstrate the use of the following instruments and implements :

(a) Steel rule, Scales.
(b) Outside and inside callipers.
(c) Dividers.
(d) Centre punch and prick punch.
(e) Marking gauge.
(f) Micrometer.
(g) Depth gauge.
(h) Height gauge.
(i) Thread gauge.
(j) Feela gauges.
(k) Vernier Callipers.
(l) V-Blocks and surface plates.
(m) Go and not go gauges.
(n) Spanners.

The students should be asked to measure of different types, different dimensions such as outside diameter, inside diameter lengths, depth of holes, sizes of screws, clearances etc. of different machine parts with the help of these instruments.

They should also be asked to use marking blocks steel rules V-Blocks and Surface plate to mark location dimensions and holes.

In addition to the above exercises the students should complete at least 4 exercises entailing marking, chipping and filing to given size drilling tapping holes, tapping of holes by means of taps, cutting screw threads by means of dyes. M. S. plates 1/8″ thick may be used for these exercises.

B. Turning metal components:

1. (a) Grinding of Simple Turning tools.

The teacher while teaching how to grind simple turning tools should demonstrate the following tools normally used in turning:

(i) Plain turning tool: right handed and left handed.
(ii) Side Cutting Tool: right handed and left handed.
(iii) Parting tool.
(iv) Plain boring tool and screw cutting tool.

(b) The teacher should also show the various angles such as tool angles e.g. rake, clearance etc. and explain the importance of each of these angles for cutting hard or soft metals.

(c) After having giving above instructions on various tool form and tool angles he should demonstrate batch by batch how to grind tools one form at a time and explain.

(i) how to hold tools.
(ii) how to set the tool rest and how to support the tool on tool rest and
(iii) how to grind the tool angles properly.

(d) He should also impress upon the students.

(i) necessity of using gogles.
(ii) dressing of grinding wheels at intervals.
(iii) how to measure the tool angles.

(c) Normally a student is expected to grind at least two tools one under 1 (a) and one from (ii), (iii) & (iv).

B. (2) Making simple turning jobs.

Before asking the students to take up turning jobs the instructor/teacher should take the students in a batch and explain to them various parts of a lathe such as

- (i) Lathe bed.
- (ii) Head-Stock.
- (iii) Tail-stock.
- (iv) Slide with tool post.
- (v) Lead screw.
- (vi) Gear or come pulley for changing speeds. The function of each one of these components should also be explained and demonstrated.

The teacher should demonstrate the use of :—

- (a) Centres.
- (b) Face plate.
- (c) Chuck.
- (d) Clamps.
- (e) Too post.

Having explained these he should proceed to demonstrate turning of simple jobs, specially with respect to—

- (i) marking the centres.
- (ii) making centre holes with centre drill.
- (iii) fastening the job in the clamp.
- (iv) putting the job on the lathe.
- (v) fastening the tool on the tool post and adjusting it on the centre line of the job.
- (vi) change the gear/cone pulley to get the correct cutting speed.
- (vii) changing of tools for plain turning, side cutting, parting, plain boring as the case may be.
- (viii) use of lead screw for cutting screw thread (outside).

After explanation and demonstration the students should be given turning following turning jobs :—

- (1) One job for plain turning.
- (2) One job for taper turning, side cutting, grooving etc.

(3) One job for boring.

(4) One job for cutting screw thread (outside).

C. Welding operation.

1 **Shop talk :** Gas welding.

The instructor should explain the (a) gas welding process, use of Oxygen-Acetelene for welding, bottled gas. (b) Use of blow torches for (i) welding and (iii) flame cutting.

He should also demonstrate how to adjust for right kind of flame suitable for heating, welding and cutting. The students should be asked to adjust the torches as demonstrated by the instructor.

This should be followed by demonstration of welding, use of welding rods and getting proper beads and layers of weld for lap, but right angle joints.

Practice :-

The students should complete at least 6 exercises in welding such as butt joint, lap joint, Tee or right angle joint. For gas welding 10 or 12 gauge M. S. Sheets are recommended.

2. **Shop talk on Electric Welding.**

The instructor should explain the construction of welding generators, welding transformers, welding current, correct voltage etc.

He should demonstrate the process of welding, proper holding of electrode holder, laying of beads. He should also impress upon the students the necessity of using proper goggles or shields and gloves.

Practice :

Students should be made to practice (a) how to strike and maintain the arc (b) how to run straight beads making of lap weld, butt welds, corner weld (c) welding of thin steel sheets and (d) patchwork on automobile bodies by welding.

Every School Library should have—

1 TEACHERS' GUIDE: Published for the Nuffield Foundation by Longman (Penguin Books).

For Nuffield Science Teaching Project.

Examples: Nuffield Physics Teachers' Guide I, II, III etc.

II. Education films:

Every technical school should have a 16 mm sound projector and some films. Films may be exchanged amongst schools. The Council of Higher Secondary Education or the State Council for Technical Education should have a film library. The Central Film Stores may lend films to the different schools—particularly those in the villages. If time is short recourse may be taken to projection. If there is plenty of time demonstration experiments may be shown in the class or in the laboratory.

Practical work is essential not just for learning but for pupils to make their own personal contact with the work with its delights and sorrows. Pupils should do experiment on their own under instructions from the teacher. A wise teacher will provide the correct environment. Working on their own, children will do far fewer experiments in the time available. To make up for that the teacher should do more demonstrations and project slides and/or films.

FABRICATION PRACTICE THEORY.

Contents in the Syllabus.	Break up of Content	Suggested Periods	Suggested References	Page. Nos.
A. Structural Drawing.	Free hand drawing. Drawing of standard structural steel Sections : beams, channels, equal and unequal angles, bulb angles, Tee bars.	30	1. Engineering drawing T.T.T.I. Publication.	25-32
Free hand drawing, Skelding of simple structures, drawing of standard beam, angle etc. sections.	Beams, channels and compound Sections used as girders. Angles used as truts & tees.		2. Fundamentals of engineering drawing. W. J. Luzadder. Prentice Hall India.	151-169
Blue print reading of structural drawings. Roof trusses, girders, crane structures, water tanks etc. Tension and compression members in structure.	Beams, channels and other compound sections used as columns. Roof trusses, girders, crane structures; beams to girder, column to column, girder to column connections. Column beam connections. Foundation. S. and R.C.C. construction. water tanks. Making Blue Prints and other types of prints & reading.	45	3. ISI Hand book for structural engineers. Structural Steel Sections. 4. Civil engineering drawing D. N. Ghose Rakamari Book House 5. Civil engineering drawing. R. S. Malik & G. S. Meo. New Asian Pub. 6. Reinforced concrete	49-120 188-202 237-244 482

Contents in the Syllabus.	Break up of Content	Suggested Periods.	Suggested References	Page Nos.
			K. L. Rao. Charotar Book Stall. 7. Blue print reading. NPC Delhi. 8. Reading of blue prints & sketching. NCERT.	
	Piping and welded construction.			
	Geometry of sheet metal work, radial line, parallel line and triangulation method.		9. Geometry of sheet metal work. A. Dikson. Pitman.	7-77
B. Rivets and riveted joints			10. Design of Steel structures.	15-29
Properties of rivet heads, rivet materials, drilling and punching rivet holes, standard wrought iron and steel rolled sections. Forms of rivet joints, chain riveting, lap and butt joints, Combined lap and butt joints. Strength of rivetted joints. Best diamater of rivet in relation to thickness of Plate. Efficiencies of	Same as Previous Column.	20	A. S. Arya & L. L. Ajamain. Nem Chand & Bros.	185
			11. Mechanic elements Dobrovolsky and others. Peace Publishers, Moscow.	91-107
			12. Design of metal Structures. Mukhanov. Mir Pub. Moscow.	126-141
			1. 13. Basic engineering craft course.	110-111

5	rivetted joint, Rivet joint of structures. Sheet metal work. Raveting tools and machines.			Workshop Theory (Mechanical) R. L. Timings. Longmans.	116-129
	C. Bolts, nuts and Screws. Forms of screw threads, proportion of threads, various types of bolts & nuts, locking nuts and arrangements, foundation bolts, spinners, strength of bolts, bolt joints, dimension of bolts & nuts.	-Do-	10	1. 2.	105-110 353-375
	D. Welding and Welding joints. Oxyacetylene welding, electric arc welding, electrodes, arc welding equipment, motor generator sets. Welding of various materials, inspection of Soundness of fusion welds, strass in welds, safety guard and eye protection. Advantages of	-Do-	20	14. Workshop Technology. Vol.-I B. S. Raghuwanshi. 15. ISI Handbook of Manual, metal arc welding. 10. 16. Process equipment design. Hesse & Rushton. Affiliated East-WestPress. 12.	467-482 31-47, 247 75-93 93-124

Contents in the Syllabus.	Break up of Contents	Suggested Periods.	Suggested References	Page Nos.
welded joints in structure and pressure vessel. Forms of welded joints, welded joints strength and efficiency.				
E. Elementary Study of simple Structures. Structural elements, beams, cantilevers, Columns & struts, slab, foundation and footing. Operation and care of rivetting and welding machines and tools. Safety measures and safety devices.	-Do-	25	17. Elements of Structure W. Morgan. Pitman. 6. 18. Management D. C. Das 19. Shop Theory. Anderson & Tato.	72-138 164-180 110-158 186-191
F. Steel Water tanks. Steel and wrought iron tanks, arrangements of stays and ties to support sides, tank stays and ties to support side tank stays and their fittings.	-Do-		10.	493-507

G. Jigs and fixtures and their uses.	-Do-	10	20. Elements of workshop Technology. Vol-II 505-523 Hazra Choudhury 21. Workshop Technology. Vol-III 348-382 W. A. J. Chapman. ELBS Lowpriced Texts. 2. 521-530

Suggested Texts.

1. Basic Fabrication and Welding Engineering
F. J. M. Smith. Longmans.
2. Welding and Fabrication
W. Kenyon, Pitman.

FABRICATION PRACTICE PRACTICAL

Contents in the Syllabus.	Break up of Exercises	Suggested Classes	Suggested References.	Pages Nos.
A. Structural Drawing Practice. Making sketches and drawings of structural components. Making of blue and other types of prints.	(*i*) Drawing of structural components and simple assembly	12 Clases of 3p each 6 Classes of 4peach.	1-9. as indicated under Fabrication practice (Theory) Fabrication Practice (Theory)	
	(*ii*) Development and inter-sections	4(3p) 2(4p)	2. 10. Basic Sheet metal practice. J. W. Giachino. D. Van Nostrand. Co.	Pages 232-271 Pages 179-238
B. Fitters Shop Practice Use and care of fitters tools, measuring instruments, use of hard tools, hammers, vises, chisels, files. etc. Marking of a job. Use of different types of calipers, scales, micrometer and measuring	Use and cane of tools 1. Chipping, filing, sawing, drilling, tapping.	18(3p)	11. Shop theory. Henry Ford Trade School.	Pages 7-8, 16-19, 22-25 42-46; 53-66 72-91
	2. Making a simple plate	8(4p)	12. Workshop Practice	

gauges. Principle and practice involving chipping, filing, Sawing etc. Use of tapes and dics. Use of drills and grinders, standard threads, types of fits. Elementary knowledge of limits and tolerances. Different types of spinners and their uses.	gauge (go, not, go type) 3. Making a profile gauge e.g. for a tool handle such as file. 4. Marking out drilling, spot facing, counterboring and checking of hole centres. 5. Marking of large template. 6. Laying out templates for a roof truss.		and shop talk-1 T.T.T.I. Publication 13. Basic Fabrication and welding engineering F. J. M. Smith. Longmans. Chapter. 5.	60-81
C. Rivets and Riveted joints. Making of different type of rivets, rivet heads, drilling and punching rivet holes in plates. Study and making different types of rivet joints, sheet metal works. Care and maintenance of riveting tools and machines. Making rivet joint in simple structure.	1. Hammering practice. 2. Making a square bar from a round rod. 3. Making a hexagonal bolt head on a round rod. 4. Making a dooring with hook. 5. Making a S-hook from a rod. 6. Making a cold chisel from a square bar and heat treatment of the same.	16 (3p) 9(4p)	12.	Pages 37-59
D. Forging Practice Simple forgeshpi problems involving drawing,	7. Soldering of wires, tubes. 8. Brazing of band saw blades. 9. Study of different types of rivets, rivet heads, riveted joints,		14. Welding and Fabrication. W. Kenyon. 14. Pitman	Pages 78-81

Contents in the Syllabus.	Break up of Exercises	Suggested Periods.	Suggested References	Pages Nos.
bending, forming, upsetting etc. Tempering of tool steel, soldering.	riveting tools and machines.			55-57
	10. Riveting Practice.		12. Pages	101-103
	11. Making a riveted lap joint.		14. Pages	113-120
	12. Making a riveted but joint		13. Pages	193
E. Welding equipment and tools and their uses. Practical work of gas welding, electric welding. Flame cutting. Making welded joints in simple structure.	Preparation of end plates, 1. Study of welding equipment and tool.		12. 13.	84-101 272-304
	2. Gas welding practice.			150-165
	3. Welding of a butt joint by leftward gas welding.	16(3p)		
	4. Welding of a butt joint by rightward gas welding.	8(4p)		
	5. Electric arc welding practice.			
	6. Welding of a double fillet lap joint.			
	7. Welding of a double fillet T-joint.			
	8. Welding of a double fillet V-butt joint.			
	9. Flame cutting.			
F. Jigs and Fixtures.				
Making Jig and Fixture	Different types of clamps.	4(3p)	13.	166-184
	Clampling work for: Folding,	2(4p)		

for a simple structure	riveting, welding. Use of plate dogs and pins, strong-backs, cleats, glands, dogs and wood blocks, bridge pieces, chain and bar, jack clamps, spiders.			
G. Techniques in assembling structural parts.	Fabrication Processes: Folding, bending, spring-back. Folding machines. Bending machine. Press brakes, Roll bending. Forming sheet metal. Hollowing and Raising. Spinnning and Spinning lathes. Allowances for sheet metal work. Deep drawing and pressing. Stiffening and wiring, swaging. Making of structural connections and assemblies; *Sheet metal* work (for some of the drawings done under A)	12(3p) 7(4p)	13. 14.	Pages 223-271 Pages 124-128
H. Testing of structural joints.	Testing for load, pressure, defects in joints.			

ELECTRICAL SERVICING & MAINTENANCE

Considering 52 Sundays and 89 days for vacations and examination, no. of working days available=224 per year.

No. of working weeks=224÷7=32 per year.

No. of periods available=32×3 periods/week×2 years.
=192 in two years.

Item No.	Description	No. of periods allotted.
1.	Brief description of common methods of generation of electricity—A.C. and D.C. and working of steam and hydroelectric power stations. Advantages and disadvantages of A.C. over D.C. Different systems of transmission of electrical power. Methods of distribution of A.C. and D.C. power to urban and rural areas. Merits and demerits of overhead and underground systems of distribution. D.C. 2-wire and 3-wire systems; A.C. single phase, 3-phase, 3-wire and 4-wire systems with relative advantages. (Mathematical calculations should be avoided.)	17
2.	Discussion over low and medium voltage service connection from over head lines (terminal and tangent poles) and underground supply to consumers' D.B. Relevant I.E. Rules.	6
3.	Earthing of low and medium voltage installation and overhead lines. Methods of pipe and plate earthing. Treatment of person suffering from electric shock. Other items as mentioned in the syllabus.	10
4.	As mentioned in the syllabus.	6

5.	Only description of the wires. Other items as mentioned in the syllabus.	6
6.	Only application of the accessories.	9
7.	Types of wiring with merits and demerits. Other items as mentioned in the syllabus.	9
8.	Wiring diagrams with one-way and two-way switches, fan with regulators, two pin and three pin plug points, Calling bells, Heaters etc. Other items as mentioned in the syllabus.	9
9.	Lay out for single storied building only from low voltage supply D.B. Other items as mentioned in the syllabus.	9
10.	As mentioned in the syllabus.	3
11.	Demonstration of the appliances with brief description.	9
12. (a)	Principle of working of d.c. motors. Different types of d.c. motors and their application. Principle of working of a.c. motors (single phase and three phase), universal types. Other items as mentioned in the syllabus.	15
12. (b)	Brief description only.	6
12. (c)	As mentioned in the syllabus.	3
12. (d)	Demonstration of the articles with brief description.	6
12. (e)	D.C. Armature winding—Lap and wave. Winding rules. Demonstration of the items mentioned in the syllabus.	15

12. (f)	As mentioned in the syllabus.	12
12. (g)	Principle of stator and rotor winding. Winding rules. Demonstration of the items mentioned in the syllabus.	15
12. (h)	As mentioned in the syllabus.	3
12. (i)	—do—	3
13.	—do—	6
13.	Transformation ratio. Losses in transformer. Function and use of auto-transformer.	15
	Other items as mentioned in the syllabus.	
	TOTAL	192

RADIO & ELECTRONIC SERVICING & MAINTENANCE

Subject—(No. of Periods)	*Topics of Importance*	*Demonstration Experiment*
I. *Electronic Materials* (8)		
Iron, Copper, Aluminium, other metals and alloys, Magnetic materials (2)	Constitution. Important applications, properties of the materials that are exploited: Where used in industry	Demonstration of the conductors. Behaviour of dielectric in alternating field of conductors, Dielectric constant of insulators, B-H loop of ferromagnetics, Q-values of coil. Power factor of condenser. Other special features of conductors, insulators and magnetic materials as judged by the teacher.
Ceramics and insulators Ferrites, dielectric materials. Ferro-electric materials. (3)	Constitution : Properties that are exploited: Where used in industry	
Glass & fluorescent materials, Indigenous materials (1)	Important industrial applications	
Questions and Answers (1)	Questions as will rouse the interest of the students and will lead to creative thinking.	Problems in industry for proper materials. Import substitution.

Books :

(1) Electrical Engg. Materials

A. J. DEKEER,
Prentice Hall

Relevent portions of the books to be chosen by the teacher and fixed by the No. of periods to be devoted to the teaching.

Subject—(No. of Periods)	*Topics of Importance*	*Demonstration Experiment*
(2) Engg. science and Calculations (for Craftsmen in Engg. Industry), Vols : I, II, III W. E. FISHER The English University Press Ltd. London.		
II. *Electronic Devices and characteristics* (15)	Constitution. Fabrication Current voltage characteristics, Nature of the characteristics to be shown and explained with reference to their practical application in industry.	Demonstration on the characteristics either by experimental and graphs or by CRO.
Semiconductor diods and transistors : BJT, FET, MUSFET, SCR, SCC, UJT, Thyristor, LED's (5)		Demonstration of the devices and their performance.
Thermionic diodes, triodes, pentodes, Thyratoon, Magic-eye. CR tubes TV camera and picture tube (6)	Principle of conduction to be explained. Holes and electrons to be explained.	Instruments or equipment made with the devices.
Integrated circuits, Photocells. Phototransistor, Noon signer (2)	The detailed sketches of the electrode disposition and their action to be explained.	Demonstration of the performances. Comparison of thermionics and semiconductor devices.
Questions, Answers, and Availability in the country (2)	Mathematical formulas to be given without deduction. Only those formulas that are important in the practical application are to be given.	Demonstration of CRO tube, TV Camera tube, Photo cells, LED's etc to be given with suitable apparatus.

	Action of CRO, TV Camera tubes and picture tubes, photocells etc to be explained with elaborate sketches. Sensitivity to be explained. Factors controlling sensitivity to be mentioned.	*Films may be projected* Slides may be used when sound projectors are not available. Sound projectors (16mm) are most suitable.

Books on (II) Electronics—ANGELO—McGraw Hill
Principle of Electronics —B. Chatterjee —Asia
Fundamentals of Electronic Devices & Circuits : Weed & Davis, Prentice Hall
Industrial Electronic Engineering —Davis & Weed —Prentice Hall

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Solid State Physical Electronics —Van der Ziel —Prentice Hall
Electronic Fundamentals & Application —Ryder —Prentice Hall

Also Taroporevala Publication on Electronic devices, circuits & application also Basic Radio Vols. I to VI by M. Tepper (Taroporevala & Sons P. Ltd. Bombay). (Oxford Book, Calcutta or Taroporevala & Sons P. Ltd., Bombay)
Introduction to Electronics by P. E. Gray —Wiley Eastern Ltd.
Basic Electoronics Jonson & Zeruiyan-Tarapoerala & Co. (Bombay)

III *Electronic Circuits and their performances*	Necessity of rectifier : Low, medium & high Circuits, diagrams and their performance.	Demonstration with CRO of the effect of half-wave, full-wave etc. rectifiers, and action of filter.
Rectifiers (2) Voltage amplifiers (1)	Explanation for : half wave, full-wave, bridge rectifiers: Semi conductor/metal/thermionic.	Demonstration with signal generator and load. with the help of CRO.

Subjects—(No. of Periods)		*Topics of Importance*	*Demonstration Experiment*
Negative feedback	(1)	Qualitative comparison of performance ripple factor: filter etc.	Load operation. dB—meter etc.
Power amplifiers	(1)	Circuits diagrams: & explanation of the performances. Deduction of gain. Explanation of bandwidth. Effect of negative feedback on gain bandwidth. Advantages. Deduction of gain.	
Audio and radio frequency oscillators	(2)	Circuit Diagram. Performance Characteristics : Importance	
Audio and radio frequency amplifiers	(1)	Comparison of Circuits.	
Multivibrators	(2)	Circuits of 3 types of multivibrator. Their importance in industry.	
Modulation principle and its importance : AM/FM	(3)	Principles of Radio Broadcast & TV : Simple transmitter circuits.	
Transmitters : AM/FM	(2)		
Receiver : AM/FM	(2)	Simple receivers : TRF & Superhet. Method of AM & FM Power in AM sidebands. Detector of AM and FM. No mathematics for FM	
Radio Broadcast : Transmitter	(2)		
TV transmitter	(2)	Radio Broadcast : Principles : Studio/Transmitter/Receiving & relays centre	
Broadcast receiver :		Principle only.	

Communication receiver	(1)	Principles. Methods of testing of performance.	
TV receiver	(2)		
Tape recorder (Audio)	(1)	Principles : Methods of testing & performance	
Tape recorder (Viseo)	(1)	-do-	
Radio & TV Broadcast in India : stations	(1)	No. of Stations. Modulation methods, Scanning frequency etc., S.W., MW. etc. Carrier frequencies (Bandwidth)	

Books : same as in II

Also: The Principles of Telecommunication Engineering, Vols. I, II, III.
—Harbottle and Hanman.—The English University Press Ltd. London.
and How to solve problems in Electrical & Electronics —H. Jacobocoitz —Taraporevala Publication.
Fund of TV Engs. Karvink & Safrohi (Mons)

IV.

Electronic Measuring Instruments:

C.R.O.	(2)	Description of average instruments with block schematic diagram.	Demonstration of as many instruments as possible. Alternatively projections (still or movie) of the instruments in use.
V.T.V.M.	(2)		
Time Base	(1)	Details of a commercial C.R.O. C.R.O. specifications.	
T.V.M.	(1)		
Director Finder	(1)	Circumstances under which C.R.O. is used as a measuring instrument.	
dB meter	(1)		
Ultrasonic Detector	(2)		
Microwave detector	(1)	Comparison of C.R.O & V.T.V.M.	Films displaying with 16 mm sound Projector.
Timer	(1)		
Frequency & wave meters	(2)	Block Schematic diagram of the	Charts of instruments with block

Subject—(No. of Periods)	*Topics of Importance*	*Demonstration Experiment*
Transistor Tester (1) Signal Generator (2) (Sine & Square Wave) TV pattern Generator (2) Q-meter (2) Distortion Factor meter (2) Wave form generator (2)	important sections of all the instruments.	schematic diagram.

Books as in II and III

Also Terman & Petit—Electronic Measuring Instruments

Questions on the subjects (2)

Primary & Secondary standards of the instruments (2)

Class XII

Radar and Sonar Block diagram and qualitative explanation of parts. (5) Working equations	Brief testing of pulse echo method and its advantage. Continuous Wave reflector. Explanations of radar equipment. Radar range. Maximum and Minimum range. Different types of radar (name and purpose) Radio direction finding with radar	Charts and pictures. Projection of educational film with 16 mm sound projecter.
Pulse Technique and C. W. technique. Practical application (5)		
Microwave Communication System Block diagram (3) Qualitative explanation of block. Different Bands (2)	Importance of microwave communication system. Special characteristic of such Projection still or	Charts—Pictures

Practical applications (5)	cine system. Lone of sight and boyond lone of sight communication. Direct propagation Surface reflection	
Telegraphy, Telephony Telex (3×5)		
Aerial and Propagation (5)	Qualitative description of M.W., S.W., U.H.F. and microwave aerials for transmission and reception.	Projection of still or movie picture
Method of wave propagation over ground, ionosphere, troposphere and via satellite (4)	Gain and Wasting formula (no deduction) Wave propagation (Qualitative) Mention formula.	
Typical examples (5)	graphical explanation—Propagation of M.W., S.W., U.H.F. and microwave. Specialities. Satellite Communication methods. Passive and Active Qualitative	
Instrument Repair (Two periods each) (25) Repair of amplifier, power supply, signal generator, V.T.V.M., C.R.O. etc. Repair of Radio and T.V. sets.	Principle of fault finding and repair to be explained. With the help of block sketch diagram.	With suitable film. Repair of radio, T.V., Tape record, amplifier. etc.

CIVIL ENGINEERING MAINTENANCE THEORY

Paper III

(Full Marks—100)

A. Roads

Topics	No of periods	Remarks
1. Classification of roads	4	Description. Ref : Book A Page 4-5
2. Road dimensions	4	Effective width, carriage way—Road structure. Ref : Book A page 13-17
3. Camber	4	Definition, utility and amount in different road surface. Ref : Book A page 35
Gradient		Ruling and maximum gradient Ref : Book A page 30-31.
Sight distance		Stoping sight distance and overtaking sight distance. Ref : Book A page 18-19.
4. Road Curves	4	Horizontal curves Ref : Book A page 73 Super elevation Ref : Book A page 76 Transition curves Ref : ,, ,, ,, 86 Vertical curves—summit and valley curves Ref : Book A page 33.
5. Road drainage	2	Drainage problems on different types of roads remedial measures. Ref : Book A page 44-48.
6. Hill Roads	4	Alignment Sections, tunneling, cliff gallery, hair pin bend, drainage. Ref : Book A page 36-48

		Formation in cutting and filling. Ref : ,, ,, ,, 61-62.
7. City Roads	4	Special features footpath, width, road junctions, traffic control and signals, Road signs. Ref : Book A page 49-59
8. Earthwork	4	Construction of new embankment as cutting, Profiling, dugbelling, benching, berm, spoil bank, turfling, borrowpits, lead, settlement allowance, balancing of cutting and filling. Ref : Book A page 61-65.
9. Earthen roads etc.	4	Earthen roads, gravel roads, stabilized soil roads, Roads with brick surface and their maintenance. Ref : Book A page 104-110.
10. Water bound macadam Road	4	Construction as maintenane Ref : Book A page 114-116.
11. Bituminous road	6	Construction and maintenance: (*i*) Surface dressing (single coat and double coat) (*ii*) Grouting (semi-grouting and full grouting) (*iii*) Premix—chipping carpets, concrete type Ref : Book A page 137-147.
B. Quantity Surveying		
1. Estimation of water bound Macadan Road and black top road surface. Estimation of quantities in (*i*) Surface dressing, (*ii*) Grouting, (*iii*) Premix.	12	Starting from centre line length to calculation of areas and volumes of each item. (From earthwork to finishing of the road. Quantity of materials required in each item in detail. Preparation of schedule of quantities and costing of each item.
2. Brick soling and edging etc. Surface dressing on W.B.M. rod and block top road.		Reference books— Book A page 117, 140 to 147. Estimating, Costing and specification by M. Chakraborty.
3. 25mm Premixed carpet on W.B.M. Road	3	

Topics.	No. of periods	Remarks
4. 25 mm Premixed Coupet on Block top road surface	3	
5. Seal coat with sand tutorial Internal evaluation	20	
Total :	90 periods	

1. Book 'A'— A text book of Road engineering. by Basu & Bhattyacharjee (Publisher. Orient Longman)

Teacher may consult the following books also

2. Road Technique by P. B. Sahaney
3. A text book on road engineering by Pyrashi.

C. Building

1. Earth work	5	Study of setting out the foundation for buildings—operation, Materials and instruments regd for setting out the foundation. Draw sketches illustrating setting out of foundation for a simple building, study of specification and method for earthwork in excavation in filling.
2. Foundation	8	Definition and necessity-Bearing power of soil—definition. and common method of testing the bearing power of soil. Definition of angle of repose. Simple strip foundation for walls, proportion of Footings and offsets and depths of concretes. Thumb rule method of calculating the foundation. Principle and calculations of simple foundation by mathematical calculation.

		Depth of foundation by Rankine's formula. Different types of shallow foundation with sketches viz: continuous strip foundation, stepped foundation. Arched foundation, Cantelever foundation, combined foundation, Isolated foundation, Raft foundation, Grillage Foundation.
Pile		Short notes on piles—Friction pile and Bearing pile other types—sand pile, sheet pile, screw pile. Timber pile and pile driving.
3. Brick Masonry	6	Full Brick—size etc, Three-fourth bat, Half bat, one-fourth bat, Queen-closures, King closures, Mitred closures, Squint closures, Rounded and Bull-Nose Bricks. Headers and stretchers. *Brick work* : Brick Bonds—Bonding, English bond and Flemish bond, Show by sketches walls and pillers of different size in English bond including Corner junction, T-junction and cross walls. Diagonal bond and Herring bone bond, Bonds for future extension—Toothing etc. Mortar—Lime and cement mortar, Mixing of mortar, Mortar joints, Grouting, Trowelling, Larrying, Wetting the bricks, curing of brickwork and raking out mortar joints, short note with sketches on parapets, Copings,corbels, jambs.
4. Arches, Types etc.	5	Sketch of different forms of arch viz : Flat arch, Segmental arch, semi-circular arch, Stilted arch, Two centered obtuse arch, two centered acute arch, Equilateral arch, three-centred arch, Short notes on construction of arches: Rough and Gauged (Rubbed and Axed)
Lintel		Definition, Types—Timber in wood lintel, stone lintel,

Topics.	No. of periods	Remarks
		M. S. Angle and lintel, R.C.C. lintel,
Centering		Definition, Show by sketch arrangement of centering for construction of semicircular or Segmental arch show by sketch Timber centering (form work) for casting Rc lintel, R.C. lintel with chagga.
5. Doors and Windows	4	Door opening—Soffit, Jambs, sill. Door or window frames and methods of fixing in walls.
		Shutters—Ledged or Battened, Ledged and Braced, Framed lodged and Braced, Panel, Glazed, Venetian, Combined shutter (Viz: ⅓rd panel 2/3rd Glazed etc), Flush Shutter. Steel window, Rolling shutter, Grill door, Collapsible gate, sliding door.
		Fittings—study with sketches, different types of fittings used as doors and windows. viz. Butt-hinge, strap-hinge, Garnet hinge. Sand black, hinge cleat, Handle, Aldrip bold Tower bolt, Socket bolt, Barrel bolt etc.
6. Scaffolding	3	Definition, Sketch and types viz Needle-scaffold, Ladder-scaffold, Suspended Scaffold, Desk—scaffold.
Form Work		Show by sketches Forwork (Timber centering) for Casting R. C. Slab and T-beams, R. C. Slab Supported by R.S. girsts, or box shutter fer casting R. C. Columns.
7. Roof	6	Types and short details of flat roof : Terraced roof (Barga tiled and Tea-tiled roof), Jack arch roof, slabbed roof (R. C. Slab)
Roof Crack		Causes of Leakage and crack. Repair of damaged roof.
Water proofing and heat insulating treatment of R. C. roof.		Short description only.

Roof Truss		Common forms—Lean-to-roof truss, Couple roof truss, couple closed, roof truss, Collar roof truss, King-post roof truss, Queen-Post roof truss, Fan-truss, Fink truss, House truss, Pratt truss, Knee-Braced roof truss. Sketch showing lean-to-roof with roofing tiles, Sketch showing the different members of a typical King-Post roof truss, their position and placings; two different types of roof covering, Eaves and Parapet Gutter arrangement. Sketch of a simple Steel fink roof truss. Different types of roofing materials, Sketch showing fixing of roof covering-Asbestos and G. C. I. Sheets to Timber & M. S. Angle, Channel & I section purlins by means of J & L hooks.
8. Wall finishing	5	Short description on Plastering-rendering, stucco plaster. Jointing, Printing, lime cement punning, Sand rubbing, White or colour washing, Distempering, Decorative cement painting to external surface (snowcover etc). Plastic emulsion painting.
Painting		Short note on composition of paint viz. Base, Extender, Filler, Verticle, Pigment, Thinner, Drier. Anti corrosive paint, Aluminium paint, Zinc paint, varnish paint, Enamel paint, Japan paint, Cellulose paint.
Varnishing		Definition, Classification, and uses—oil varnish, Turpentine Varnish, Spirit varnish, Water Varnish etc. Ingredients—Resin, Solvent and carrier, pigments, Driers. Short note on oiling and wax polishing, Preparation of surface before paints and varnishing.

Topics.	No. of periods	Remarks
9. Floor and floor finishes	8	Description with sketches, Brick on edge floor, Terraced floor, cement Concrete floor, Artificial stone floor, Patent stone floor, Terrazo floor, Venetian mosaic floor, Tile paved floor, Timber floor. Construction of Intermediate R.C.C. floor with floor finishing.
Staircase		Rules regarding construction and design of staircase. Classification of Stair—Closed Newal, open Newal, spiral, Bifurcated etc. (Different types with sheet desinfactive) In Sheet construction details with—Timble Stair, Stone Stair, Brick Stair, combination Stair (Iron & Brick), R.C.S. stair, sectional elevation showing details of a cast in Site R.C. Stair
10. Dampness	2	Sources, of dampness in walls, Effects, Efflorescence, saltpetre action and remedy. Damp proof course, Precautionary measures against dampness in buildings—selection of site and orientation of the building, Drafting the plan, Materials of construction, Method of constructions of Doors & Windows, Plants, and trees.
11. Underpinning	2	Definition. Explain with sketches (a) To increase the depth or width or both of a foundation for stability or safety of a structure. (b) To convert a Small opening into a big one. (c) To provide opening in a blind wall (d) To knock off a load bearing partition wall. (e) To replace undersize, or old rotten timber beams and barges new ones.

Timbering —— short note with sketch
Shoring —— Description with sketch
Dead Shore, Raking Shore, Flying Shore.

Reference Books

1. Building Construction by Mckay Vo. I to Vol IV
2. Materials and Building details by B. N. Roy
3. Building Construction by V. N. S. Murthy.
4. Building Construction by Sushil Kumer
5. by N. Sanyal.

B. Quantity Surveying

	Topics	No. of period	Remarks
1.	Centre line length, cross wall deduction, methods of taking out items of work of a small single storied residential building.	15	Reference books: (1) Estimating, Costing or Specification. by M. Chakraborty.
2.	Study of conception of materials for the following :— Brick flat soling, Cement Brick work (6:1) 12.5 cm. Brick wall in cement (3:1), 7.5 cm. Brick wall in cement (3:1), Cement concrete with Stone chips (4:2:1), 10 cm. R.C.C. Slab into stone chips (4:2:1), 0.8% reinforce-	6	(2) Specification and Schedule of P.W.D. for building works.

Topics	No of Periods	Remarks
ment, 12.5 cm. Cement pluster(6:1), Cement flush pointing (4:1), Rulled pointing(3:1), 25 mm Artificial Stone floor (4:2:1) with neat cement finishing lop for polishing, Lime terracing on roof 10 cm (7:2:2)		
		Internal evaluation—15
		Total 20 period

CIVIL ENGINEERING MAINTENANCE PRACTICE

(Practical)

1. Examination and testing of the qualities of timber :

(A) Examination of the Cross-section :

(a) Whether a timber log belongs to soft wood or hard wood is identified by examining its cross-section at the ends.

(b) The measurement of the girth of a log as the number of concentric annual rings it holds, as well as the formations of the heart wood, will indicate its maturity.

(c) The uniform growth and compactness of the annual rings, and uniformity in their colour are indications of good timber.

(d) Distinctly visible medullary rays or silver-grains are indications of toughness and hardness.

(e) Splits or clefts of any kind are considered as defects.

(B) Examination of the Long Section :

(a) Examine the nature of the grains, whether straight, twisted or wavy, as well as the straightness of the log itself. Straight logs with close and straight fibres are always better.

(b) Examine presence of knots and rindgalls—considerable number of knots, mainly dead knots and rindgalls are considered as defects.

(C) Hardness and Soundness test :

(a) Try to penetrate a cobbler's awl into the wood by the force of the hand. If hard, it will be both difficult to penetrate and withdraw. If it penetrates, and comes out easily, is an indication of poor quality. If on withdrawing from the wood the awl gives out a bad odour, it is an indication of internal decay.

(b) Hardness is ascertained by trying to cut a portion of the wood by a carpenter's chisel.

(c) Lightly strike or scratch at one end of the log and place one's ear on the other end to hear that sound. Sound and good timber free from internal decay will be sonorous when struck. Harder timber will sound better.

(D) Examination of the Planed surface:

(a) Uniformly bright and silky lustre of a planed surface indicates compactness and straightness of the grains, an indication of hardness.

(b) Examining the four planed surfaces of a square wood a fair idea of its grains can be obtained. A good timber should show its grains straight on all the four sides. If two opposite faces exhibit few lustrous strips with intervening wooly portions, is an indication of notorious woven grains. If the fibres run diagonally instead of longitudinally, it is twisted or cross-grained.

(c) Long unbroken shavings if obtained by longitudinal planning gives a sure indication of compact and straight fibre.

(E) Examination by Sawing and chiselling:

(a) A good timber is very easily sawn and does not clog the teeth during sawing. Clogging of the teeth and wooliness of the scrappings are sure indications of poor quality. Examine the saw dust—uniformity in colour and fineness of the saw dust indicates harder wood.

(b) Compact grained hard wood—Allows sharp transverse cutting or a sharp chisel-cut end will exhibit a very smooth or glossy surface.

Coarse grained soft wood—Very difficult to cut across, and a cross-cut end will be very rough and spongy.

(c) Longitudinal cuts of a chisel—If easily cut without splitting it is straight and compact grained hard wood. Splitting instead of cutting is an indication of brittleness and fibrousness is a sure indication of notorious cross-woven grains.

(F) Examination by Drilling, Screwing and Nailing:

(a) A good timber even if very hard will be easy to drill in. Harder wood is rather easier to drill. Softer wood, in general, will clog the drill bit, and it is very difficult to drill long holes. Compact grained hard wood allows easy drilling, more or less in all directions alike.

(b) Good timber allows easy screwing several times without splitting or cracking, but very difficult to detach pieces when screwed together.

(c) Poor quality of timber will take nails very easily, but at the same time allow their easy withdrawal. In certain quality of harder wood, it will be very difficult to drive nails. But if once nailed with difficulty cannot be released at all. Good timber will allow easy driving of the nails and will hold then firmly within, but it will not be very easy to withdraw then.

(G) Examination of the colour, flavour and odour of wood.

(a) Different species of timber very widely vary in their colour, but of the same species the darker is the better. Hard woods are darker.

(b) Fresh shavings or saw dusts if smell sweet, it indicates a fresh timber free from decay or disease. Unpleasant odour is an indication of decomposition of the wood. Some species are easily distinguished of their peculiar and sweet flavour.

(c) To identify a particular wood from a lot, probably its flavour or odour will be the first guide, secondly, its colour, and thirdly, its grains and texture. As for example, the 'Teak' wood and 'Sandal' wood, give up such a peculiar strong flavour that even a blind man can pick them up from thousand others. Similar instances can be cited for colour—'Ebony' is deep black ; 'Sandal' is reddish black, 'Sundari' is dark red ; 'Mahogany' is reddish brown ; 'Jarul' is reddish grey. 'Sissu' is dark brown ; Teak is yellowish brown ; 'Sal' is very light brown darkens on exposure ; 'Jack' is dark yellow darkens to brown on exposure ; 'Gamhar' and 'Kadam' are pale white.

2. Testing of bricks :

Brick. A brick can be described as a moulded rectangular mass of plastic clay chiefly composed of Silica and Alumina. The dried mass of clay is burnt to transform into a hard and durable substance with well defined sharp edges and square faces to be called as brick. It is capable of bearing the atmospheric influences as sufficiently strong to bear load, and is a useful building material.

Classification

(1) First class bricks, (2) Second class bricks, (3) Third class or Ammha bricks, (4) Jhama bricks.

Samples of each variety should be shown to the students. Following tests are to be performed with 1st class bricks.

(a) Size :

(i) **Width of a brick** Usually, the bricks are gripped breadthwise by the left hand and placed flat on the work.

So, the width of a brick should be such that it can be conveniently handled by the hand and must come within the easy grip of a brick layer which is considered as $4\frac{3}{4}$ inches on an average.

(ii) **Length of a brick.** For proper bonding of bricks in brick work, the length of a brick must be twice its breadth plus thickness of one mortar joint. The width being selected as $4\frac{3}{4}''$ and taking morter joint as $\frac{1}{4}''$ inch thick.

The length of a brick $= (2 \times 4\frac{3}{4}'' + \frac{1}{4}'')$ i.e. $9\frac{3}{4}''$ inches.

(iii) **Thickness of a brick.** Considering the weight, facility of moulding and handling and burning the thickness of brick is kept $2\frac{3}{4}$ inches.

Standard size: $9\frac{3}{4}'' \times 4\frac{3}{4}'' \times 2\frac{3}{4}''$.

(However bricks vary between $8'' \times 4'' \times 2''$ to $10'' \times 5'' \times 3''$ in size).

(b) Shape :

The uniformity of size or shape can be easily determined by arranging closely the dry standard size bricks to form into two 10″ sq. pillars side by side upto a height of eight courses. The two adjacent faces, front and right of each pillar, being made more or less straight and vertical, a straight edge is placed over the pillars and the difference of level between the two is examined. Same level of their tops indicates uniformity in the thickness of the bricks. The total height of the pillar should be 1 ft. 10 in. By examining the faces, specially the back faces of the pillars, if it is found to be more or less uniform, it indicates that the bricks possess well proportioned dimension of their length and breadth. A pair of stretchers should be less by one mortar joint ($\frac{1}{4}''$) than the full length of a header. The stability of the dry pillars and the comparative small gaps between the layers will indicate evenness of the bricks. Sharpness of the edges may be tested by moving a finger tip along the edges of the brick.

(c) Colour :

The bricks should be uniformly copper red in colour. Dark blue or black colour is due to presence of manganese and high percentage of iron. Bright red colour is due to large proportion of oxide of iron and magnesium. Absence of magnesium will turn the bricks copper red in colour. And magnesium itself if present in large quantity will turn the bricks yellowish. Absence of iron and manganese and presence of chalk in large percentage will make the bricks whitish.

Collect samples of each type for demonstration.

(d) Striking sound and extent of burning.

Bricks if properly burnt will give a metallic or ringing sound when struck with each other. Examine the fractured surface of a broken brick in determining the uniformity of burning to the core, as well as, uniformity of the grains and composition of earth.

(e) Hardness and toughness :

If the bricks are sufficiently hard finger nails will fail to make any impression whatsoever when scratched with on the surface of the bricks.

Toughness is tested by placing a brick flat cross over a brick-on-end, lifting them together and allowing to drop freely on the ground from the breast height. In any case none of the bricks should break or crack if they are sufficiently tough.

(f) Density :

Density of bricks may be judged by their weight, which should not be less than 112 lbs. to the cubic foot.

(g) Water absorption :

Porosity or absorption quality is tested by simply keeping a few bricks immersed in water for 24 hours and determining the quantity of water absorbed by the bricks, which should not be more than one-sixth of their dry weight.

3. Brick Bonding :

Prepare samples of Full brick, Three fourth bat, Half bat, One-fourth bat, Queen-closures, King-closures, Mitred closures, Squint closures, Rounded and Bull-nose bricks.

Demonstrate-Bonding i.e. show the arrangement of placing bricks in brickwork in a proper and systematic manner avoiding continuous vertical joint. The object of 'Bonding' is to interlock and create unity between the bricks and brickwork, to obtain sufficient strengths and stability of a structure and for better distribution of superimposed load.

Flemish Bond—Make two successive layers of 15″ thick wall in single Flemish bond and Double-Flemish bond.

English Bond—Make successive layers of the following.

5″ thick wall, 10″ thick wall, 15″ thick wall, 20″ thick wall, 25″ thick wall, 30″ thick wall, 10″ × 10″ sq. pillar, 15″ × 15″ sq. pillar, 25″ × 25″ sq. pillar, 30″ × 30″ sq. pillar. Right angle corner of 5″ thick walls, 10″ thick walls, 15″ thick walls, 20″ thick walls, 10″ and 5″ thick walls, 15″ and 10″ thick walls, 20″ and 15″ thick walls, 25″ and 20″ thick walls.

T-junctions of 5″ thick walls, 10″ main and 5″ partition walls, 10″ main and 10″ partition walls, 15″ main and 5″ partition walls, 15″ main and 10″ partition walls, 15″ main and 15″ partition walls, 20″ main and 10″ partition walls, 20″ main and 15″ partition walls.

Cross walls : 5″ thick walls, 10″ thick walls, 15″ thick walls, 15″ and 10″ thick walls, 20″ and 10″ thick walls.

Herring-Bone Bond and Diagonal bond.

4. Unit weight of sand :

Take sand sample which shall pass through a mesh three sixteenths of an inch square measured but not more than 10% should pass through a 76 mesh sickle.

Find the unit weight of sand:

Bulkage and Void test:

Take two containers of equal capacity open at the top, cylindrical or square in section, but not tapered. For e.g. take 9″ diameter cylindrical container made of M. S. sheet or glass 1.2″ inch high with graduation on the inner vertical face to show hundredths of the height is recommended.

Place two containers side by side on a flat platform. Fill the containers full, one with sample of saw to be tested and the other with plain water, care being taken to fill the sand without pressing. Then with a spoon, transfer the water from one container to the other containing sand, care being taken to avoid any loss during transfer. The water if gradually poured on the sand will tend to saturate it. The sand losing its false volume will sink down water the fullest extent when the water will come up to the top level of the sand.

The amount of loss in volume of the sand is the apparent amount of **Bulkage.** The volume of water consumed by the sunken sand indicates the apparent **void** in sand. By measuring the depression in the sand and water by a steel rule, or obtaining the readings on the graduations in the containers, the percentage of bulkage or void of the sample may be determined.

5. Sieve analysis and fineness modulus of sand

Apparatus used: Standard sieves of nos. 14, 25, 72, 100 and balance with weights.

Material: Sample of sand.

Theory: Fineness, Modulus, is an empirical factor obtained by totalling the cumulative percentages of the aggregates retained on each standard sieve. and dividing it by 100. The higher value of Fineness Modulus indicates coarseness of the aggregates.

Procedure:

(1) Certain quantity of sand is taken which passed through sieve no. 7.

(2) The sand screened through a no. 14 sieve and the quantity retained on the sieve is determined by weighing the sieve with sand and deducting the weight of sieve from that weight.

(3) The sand which passed through sieve no. 14 is screened through sieve no. 25 or the quantity retained on this sieve is determined by weighing.

(4) The sand which passed through sieve no. 25 is screened through sieve no. 72 and the weight of the quantities retained on the sieve is determined.

(5) The sand which passed through sieve no. 72 is screened through a sieve no. 100 and the weight of the quantity retained on it is determined.

(6) The quantity of sand which passed through sieve no. 100 and retained on pan is also determined.

(7) The sum of the cumulative percentage weight retained divided by 100 gives the Fineness Modulus.

Table for Sieve Analysis and Fineness Modulus

Serial No.	Sieve No.	Weight of empty Sieve	Weight of Sieva with retained aggregate	Weight of retained aggregate	Percentage retained on each sieve	Cumulative percentage retained
1.	14					
2.	25					
3.	72					
4.	100					
5.	Pan					

Total weight of aggregate= ____________ Total ____________

$$\text{F. M.} = \frac{\text{Sum of cumulative ·6 retained}}{100} =$$

6. Test for Normal consistency of cement

7. Initial setting time of cement

Apparatus required for both—

(1) Vicat apparatus (vicat needle 10 media).

(2) Nonporous plate to mix cement to water.

(3) Trowel for mixing.

(4) Balance and weights.

The procedure is simple and may be followed from any book. Results should be tabulated in the form of a table.

8. (a) Test for compressive strength (Test cube)

For testing the compressive strength cubes of 2.78″ sides called as Test cubes are first made with sample of cement mortar to be tested. They are properly cured and put under a gradual increasing compressive load in a Testing Machine until they are crushed. The strength per sq. inch is then calculated out.

Operation :

(1) Making the test cubes—Prepare requisite quantity of mortar normally with standard proportion of one part of cement and three parts of sand and just sufficient quantity of clean and fresh water or according to desired water cement ratio. Place a few cube moulds side by side in a glass plate. Fill up the moulds with prepared cement mortar or leave them undisturbed.

(2) Drying and curing : When the cubes are hard enough to be handled they are removed from the mortar or kept in a damp atmosphere for 24 hours. Then they are cured in clean and fresh water till they are tested.

(3) Testing : A few of the test cubes, one by one are placed under the ram of the 'compression-Testing Machine' after 3 days of curing, and a few are tested after 7 days. A test cube block being properly placed under the ram, direct compressive load is applied and increased gradually until the cube under test is crushed. The crushing strength of the sample per sq. inch is then calculated out as—Breaking load divided by the Area of test cube. An average compressive strength after 3 days should not be less than 1600 lbs./sq. in. and after 7 days not less than 2500 lbs./sq. inch the proportion of mortar (1 : 3).

WATER SUPPLY AND SANITARY SERVICES (THEORY)

Subject.	No. of periods	Remarks
A. Water Supply and Plumbing.		
1. *Water Sources* (*i*) *Ground Water*	6	Explain in short—Rain etc. as primary source of W/S. Explain with sketches—what is ground water. Ref : Book A—page 2-4, 14, Book B—page-24-25.
Springs		Explain with sketches in short about two types Ref : Book A page 4; Book B page 25.
Wells		classification on the basis of Aquifer tapped, condition of flow and type of construction only very short description with sketches. Ref : Book A page 5, 6, 14-19; Book B page-26-30.
(*ii*) *Surface water.* Natural ponds and lakes, Impounding reservoirs, Flowing rivers.		Short description with simple sketches. Ref : Book A page-7-8.
2. Development of sources	9	
(*i*) *Collection of ground water.*		Definition and sketch Ref : Book A page-2-3, 11, 16, 23 Book B page-24-25, 34.
Water bearing stratum, water table, permeability yield of a well.		
Dug wells, Tubewell and different methods of sinking.		Short description with sketches. Give sketches also of different materials and equipments used for sinking.

Subject.	No. of periods	Remarks
		Ref : Book A page-15-24.
Different types of pumps used.		Simple sketches and very short description mentioning fitting used. Ref : Book A page-25-33, Book B page-66-76.
Suitable wells and pumps for rural water supply.		Explain in short.
(*ii*) *Collection of surface water* Intake structure		Definition, ideal location and types. (The teacher may also visit the Palta water works and see the existing intakes there). Ref. : Book A page 56-61; Book B page 46-49.
Different types of pipes with accessories.		Short description with sketches. Ref : Book A-page 51-72, Book B page 49-58.
Pumps used etc.		Short description. Ref : Book A page-25-33 Book B page-66-76.
(*iii*) Case study, illustrating the collection treatment and distribution of water in a typical hill station.	6	In this connection the teacher may please contact the engineers of Public Health Directorate, Govt. of West Bengal posted in hill station for case study.
3. Impurities & purification of water. Nature and effect of impurities treatment of water, screening, sedimentation, coagulation, settling tanks, Filtration of water, slow and rapid sand filters, miscellaneous water treatment methods, Aeration, Removal of iron and manganese, water softening, Disinfection of water, Caborination etc.	15	Ref : Book A page 114-153, Book B page 82-139. Topics may be explained in short with line diagram. Chemical analysis chain detail should not be taught.
4. *Distribution of water*	15	Only short description. Design aspect should not be taught. Ref : Book A page-78-81 Book B page-141-143.

Distribution system. Methods of distribution		Ref : Book A page-88-91 Book B page-152-154.
Reservoir.		Ref : Book A page-81-85, Book B page-144-151.
Transportation of water pipes and accessories.		Types of conduit, pipes of different material, joints of pipes. Ref : Book A page-61-72, Book B page-49-58.
Pumps and pumping. Installation of pumping system.		Installation of pumping system, necessity, mention bucket lift, suction lift, pressure lift Prime mover, pumps (short description) Ref : Book A page-25-33, Book B page-66-76.
Valves and fittings.		Different types of valves used with short note and sketches. Ref : Book A page-109-111, Book B Page-162-165.
5. *Water supply to buildings.*	15	
Service connection.		Give sketch for service connection to a building. Ref : Book A page-86-87, Book 2 page-321.
Complete plumbing installation for a residential building		Show by sketch the complete plumbing installation for a residential block.
Details of pipes, pipe joint and connection, detail of fittings.		Types of pipes used viz. G. I. pipes of light medium and heavy quality, plastic pipes as manufacturer in three types etc. Pipe joints for G. I. Pipe and plastic pipe, pipe fittings viz. Bend, Tee, reducer, short piece, socket, elbow, jamnut, all types of fittings used from O. H. tank to the extreme outlet in the toilet.
Ferrule		Short note with sketch
Stop cock		Short note with sketch.
Bib cock etc.		Short note with sketch.
Hot water system in residential house.		Show by sketch fixing of Geyser in water line and supply of hot and cold water in wash basin, shower and tap in the bathroom.

Subject.	No. of periods	Remarks
Domestic water pump and its maintenance.		Different types of pumps used in domestic water supply with short description. For domestic supply. Pumps fitted in tubewell when water level is low. Oiling and greesing of parts, replacement of packing materials at intervals and other maintenance required.
Internal Evaluation—	15	
Total	90	period

Reference Books

1. Book A—A text Book of water supply Engineering
   By R. P. Singhal (Publisher—Singhal Publication)
2. Book B—Elements of PUBLIC HEALTH ENGINEERING
   By K. N. DUGGAL (Publisher—S. Chand & Co. (P) Ltd).
   Reference books for teachers.
3. Rural water supply & Sanitation by Wright Forest Blyth
   (Publisher Wiley Easterin)
4. Water supply Engineering by H. E. Babbit.

B. SANITARY SERVICES

Subject.	No. of period	Remarks
1. Sewage—general consideration Definition of various terms	7	Definition etc. Ref : Book A page 1, Book B page 175 Some definitions in connection with sanitary engineering viz, sewer, Drain, House drain, Lateral sewer, submain or

		branch sewer, main outfall sewer, Intercepting sewer, sewerage, Invert, self-cleansing velocity etc. Ref : Book A page 5-6
Types of sewer		State different types of sewer. Sketch of Layout of sewers. Ref : Book page 177-179
Excreta disposal for unsewered areas.		Short notes and general discussion. Refuse disposal, Earth closet, chemical closet. Bore hole latrine, pit privy cesspols, Aqua privy, septic tanks etc. Ref : Book A page 123-125.
Conservancy		Short discussion on the conservancy system and explanation of the terms Garbage, sullege, Night soil etc. Ref : Book A page 2-3.
2. Urban and rural latrins House drainage in details with study of various sanitary fittings and fixtures including connection with public service line in detail.	9	Short discussion with sketches, sketching and reading a complete drainage plan of a building including connection with Municipal street sewer sketching and reading a section of a building showing water supply and drainage connection particularly soil pipe, anti-syphonage pipe, Rainwater pipe, traps etc. Study of various sanitay, fitting with sketches. Short note with sketches on modern Bath room. Gulley, Trap, Grease trap, Intercepting trap, Inspection chambers, water closets, Flushing cisterns, ordinary in automatic, urinals, vent pipe, wash basin. Examining water tightness of Drain and pipe. Ref : Book A page 109-120
Sewerage : Sewerage system	10	Short description of different systems and their comparison. Ref : Book A page 4-5.

Subject.	No. of periods	Remarks
Construction of Sewers		Short description with sketches Ref : Book A page 11-13, Book B page 202
Sewer pipes		Study of different types of pipes with sketches and short description. Ref : Book A page 9-12. Ref : Book B page 201-202.
Sewer appurtenances		Short description with sketches of manholes, lamp holes, drop manhole, Inlets, catch basins and traps, flushing tanks, Leaping weir, overflow weir, syphon spitt way, Inverted syphon outlets. Ref : Book A page 42-54, Book B page 226-237.
Laying		Laying of sewer lines, description with sketches. Ref : Book A page 14-17.
Jointing		Short description Ref : Book A page 17-18 Book B page 204-208.
Repairing and testing of sewer lines.		Short description. Ref : Book A page 21-23, 119/Book B page 209-210.
Ventilation of sewers		Short notes. Ref : Book A page 19-21.
Self cleaning velocity.		Definition, Ref : Book A page 6.
Different types of joints and Jointing material.		Short description, Ref : Book A page 17-19 Book B Page 205-206.
4. Characteristics of sewage, B.O.D. suspended solid etc.	3	Short discussion on the following topics sewage strength, sewage properties, Biology of Sewage, Chemical test. Ref : Book A page 55-60.
5. *Treatment of Sewage* Different methods of treatment.	10	Main purpose of treatment and classification in short. Ref.: Book A page 70-71.

Screening		Necessity and types of screens viz. Coarse Screens, Medium Screens, Fine Screens, Disposal of Screenings, Skimming tank Ref : Book A page 71-73.
Sedimentation		Short description and types of sedimentation tanks. Ref : Book A page 73-74.
Trickling filters		Purpose of sewage filtration, sketch of the trickling filter, short description and its advantages and disadvantages. Humus tank. Ref : Book A page 95-97, Book B page 295-296.
Activated sludge process		Diagram of the process, short description. Advantages and disadvantages and different methods of Aeration. Ref : Book A page 100-104. Comparison between Activated sludge process and trickling filter.
Oxidation pond		Short description. Ref : Book B page 307.
Disposal		Necessity, different methods viz Dilution into-river, sea, streams etc. and Irrigation of land, Advantage & disadvantage. Ref : Book A page 62-67.
6. Septic tanks	8	Principles of operation, sizing for domestic use, construction detail and disposal of tank effluent. Ref : Book A page 83-87 Book B page 277-281.
7. Sludge disposal	6	Necessity. Types of sludge and treatment necessary, Different methods of sludge disposal. Ref : Book A page 104-105 Book B page 291.
Sludge digestion.		Purpose and process of sludge digestion, sludge digestion tank. Ref : Book A page 106-108, Book B page 286-290.
Disposal of solid waste by Land fill.		Short note. Ref : Book B page 346-347.
Composting		Short note Ref : Book B page 347-348.

Subject	No. of periods	Remarks
Incineration		Short note Ref : Book B page 347
Internal Evaluation	15	Ref : Book A page 126
TOTAL	90 periods	

Reference Books

1. Book 'A'-A text Book on Sanitary Engineering. by Prof. R. P. Singhal.
2. Book 'B' Elements of Public Health Engineering. by K. N. Duggal.

Teachers may also consult the following books.

1. Sewerage and sewage treatment by H. E. Babbitt.
2. Water supply and waste water disposal by Fair and Geyer.
3. Sanitary Engineering by Babbitt and Babbitt and Doland and Cleasby.

C. Quantity Survey—22 periods.

Reference Book :

Estimating and costing by M. Chakraborty.

Teacher may please consult the P. H. Engg. and P.W.D.

Schedule of rates for sanitary and water supply works.

WATER SUPPLY AND SANITARY SERVICES

PRACTICAL

A. Plumbing.

1. Identification of galvanised iron pipes (I.T.C.).

(a) Heavy quality, (b) Medium quality, (c) Light quality. A particular length of each variety may be weighed to see the difference.

G. I. fittings (identification)

Socket, Reducing socket, Nipples, Bend, Plain equal elbow, Reducing elbow, Plain Tee, Pendent Tee, Reducing Tee, Jam nut, Plug, Long screw with two fittings socket and jam-nut, Union joint, W. I. flange with crasher and bolts.

Polythene pipes (identification).

(a) Normal guage, (b) Heavy guage, (c) Medium guage, (d) Light gauge, High density polythene pipes.

Polythene fittings (identification).

Pipe bends with outside BSP threads, caps with inside BSP thread (Plug), Caps (Plugs) with outside BSP threads, Cross with B.S.P. Threads, Elbows with outside B.S.P. Threads, Elbows with B.S.P. Female threads, Reducing Socket with inside B.S.P. threads, Sockets with inside B.S.P. threads, Tee (equal) with outside B.S.P. threads, Tee (equal) with B.S.P. threads, Female Coupler with outside B.S.P. threads (straight), Bends (short) with B.S.P. Female threads, Tee (Reducing) with outside B.S.P. threads, Tee (reducing) with B.S.P. Female threads, Adapter male or Female, Couplers straight (equal) cross (equal), Elbows (equal), Plugs, Saddles, Tees (equal), Unions (equal).

Valves & Cocks (identification).

Ferrule, Peet's valve (gun metal), Brass stop cock, Brass bib cock, C. P. pillar cock, Horizontal check valve, Vertical check valve, Wheel valve.

Note. Identification of materials as also of the tools used should proceed along with jobs to be executed by the students along with short talk.

2. G. I. pipe works and the fittings.

(a) Pipe cutting:

Use of Vise, Steel scale, Marker, Hack saw, Cutting wrench. Material—G. I. pipe.

(b) Threading:

Use of Vise, Dies, Bush, Blades, Handle, Slide Wrench material—G. I. pipe.

(c) Tapping:

Material—4″ dia. C. I. water main. Use of vise clamp, Drill, Tap, Handle.

(d) Pipe jointing:

Material—G. I. pipe.

Use: Wrench vise, Make thread, use also chain wrench instead of vise, Fix socket on the thread pipe with Havoc and jute. Fit the other pipe in the socket.

(e) Fixing and laying:

Lay and fix G. I. pipe in the wall with holder bats clamp or hook and make branch lines with G. I. pipe specials (viz. elbow, socket, teeth etc). Fix a shower and a bibcock.

Dismantling and re-assembling of valves and cocks.

Peet's valve : Fix the valve in the vise and dismantle its parts with slide wrench. Examine the individual parts. Material : Gun metal.

Body—Examine the inlet and outlet of water. Any side can be taken as inlet. Observe the guide for flap of the spindle, when the flap is lowered it completely closes the opening and when the flap is lifted the passage for water is clean.

Spindle valve with flap and thread rod—the threaded rod is screwed inside the spindle.

Cap—Smooth circular hole althrough when spindle operates.

Gland bush : Fitted at the top of the cap.

Gland nut : Fitted with the cap over the bush.

Spindle : At the top of which the wheel is fixed and at the lower end it operates the spindle rod to move up and down. Spindle cannot come out at top because of projected ring at the centre wheel fits in the recess in the cap.

Jam nut : Special type jam nut fitted at the bottom of the cap it keeps the spindle in position at lower end.

Wheel with nut : It operates the spindle from top. The nut keeps wheel in position.

Gland packing : Asbestos fibre packed inside Gland nut. It prevents leakage of water by the side of spindle.

Stop cock : Material : Brass.

Body, Cap, Spindle, Gland nut, Valve, Washer, Nut, Handle, Gland packing.

Piller cock : (Material : Cromium plated outside, Brass).

Body Cap, Outside cap, Spindle, Gland nut, Washer, Valve Nut and one jam nut for fixing with basin. Wheel handle at top.

Bib cock : (Material : Brass).

Body, Cap, Spindle, Gland nut, Packing, Washer, Valve Nut.

Wheel valve: (Material: Gun metal).

Body, Spindle cap, Spindle, Jam nut, Gland bush, Gland nut, Asbestos packing.

Note: Water flows in one direction only.

Long screw joint:

G. I. pipe with long thread i.e. twice the length of socket, jam nut, havocs, jute etc.

3. Cast iron pipe (Water main).

Lead caulked joints of C. I. pipes.

Place C. I. pipe in a Brick platform (levelled properly) insert the pipe end into the socket of the other pipe. Packing to be done with gasket. Then place a wet thick rope around the pipe inside the socket. Cover the rope with mud and then pull the rope out very slowly leaving cavity alround the pipe. Pour lead which should be in melted condition in the hole. Allow it to just solidify. Press the lead with hammer and blunt chisel to a smooth and compact finish.

Make connection with C. I. Tee, C. I. Collar, C. I. Bend.

4. Cisterns:

Pull and let go cisterns:

Completely dismantle the cistern and study different parts as follows:

Body: Made of cast iron. The rectangular body with top open has got a central hole at the bottom. The central portion of bottom has got uniform circular depression to receive the valve base on the upper part it has got two holes on two sides.

Syphon: Made of cast iron. It is cylindrical with bulged central portion. Both ends open. The lower end is threaded. The threaded portion passes through the hole of the body.

Jam nut (Brass), Washer (Rubber) etc : The syphon is fixed to the body by these fittings.

Syphon valve : Made of cast iron. It looks like glass tumbler. It sits over the syphon and its base rests on the C. I. body. It has got two projection hooks at top and a small hole at base.

Cover : Made of cast iron. It is rectangular in shape and sets on the body. Its central portion is elevated for accomodating the value in lifting condition. There is slot at top through which the lever and handle operates.

Lever and handle : The handle is pinned at the top with the lever arm which pulls the valve by lifting the projected parts of the valve.

Chain : M. S. Chain with handle at one end and its upper end is fixed with the lever arm handle.

Ball-cock : Ball made of polythene or copper, Ball cock rod-brass or aluminium made. The cock (valve) is fixed with the body with washer or brass jam nut. The cock has got two parts one the brass cylinder and the other brass piston with rubber washer at one end. There is a slot in the cylinder through which the small link of handle operates. The rod is connected with the body by pin. Up and down motion of the ball transmits to and fro motion of the piston inside the cylinder.

Over flow : Made of polythene pipe with one end closed and perforated for mosquito proof arrangement and is fixed at oneside of the body at top.

Low down cistern : C. I. body, U-shaped syphon (C. I. or polythene) fixed with the body with brass washer and jam nut, syphon valve (brass) ; valve rod and valve disc with semi-circular slot with a flap which is hinged in the slot side and operates in one direction only. Handle (C. P.) with valve rod. Ball cock arrangement : Same as above.

Automatic cistern :

Dismantle the cistern and study the different parts, viz. C. I. body, syphon made of copper sheets and lead pipe and brass bottom with soldering joints, etc.

5. Basins & Sinks :

Fix wooden blocks in wall. Fix C. I. brackets in the wooden block with screws. Place the basin or sink and fix it with the bracket. Check the level. Place waste fittings (Brass or Polythene make). Notice that for Basin half threaded fittings and for Sink full threaded fittings. Connect it with waste pipe (made of Polythene or lead) with brass coupling at top. C. P. Chain and plug (rubber). Fix Pillar cock in the basin and connect it with ½″ connector pipe (made of lead or polythene) with brass couplings at both ends. Fix nipple and stop cock.

Similarly make Stop cock and Bib cock connection for Sink.

6. Hand pump for Tube well :

Completely dismantle and reassemble a hand pump for tube well and study the different parts viz., C. I. body, C. I. head, C. I. handle, Spindle rod (M.S.), C. I. plunger with C. I. valve, Leather bucket, Bush, C. I. base, Leather sheet valve, C. I. weight, 3 m bolts and nuts at top and 4 m bolts and nuts at base. Fix a G. I. pipe at base and show the operation of hand pump in a small tank filled with water.

7. Tube well sinking :

Scaffolding : Three bamboo structure with runners and bracings. Minimum height of Scaffolding 25 ft. Take one length of G. I. pipe. Fix cutter at lower end of pipe and at top fit flexible coupling and Boring machine set. Rotate the pipe by holding with chain wrench.

Examine the parts cutter pieu plug, strainer etc.

Strainer.

See different type of strainers used viz. Brass (mesh) strainer, Brass jacketed strainer, Polythene strainer, Coir rope strainer.

Open these strainers and examine different parts.

B. Sanitary.

1. Identification of pipes and fittings.

(a) Cast iron soil pipe.

Heavy quality and Ordinary quality.

Fittings:

H. C. I. single junction with door, H. C. I. Inspection door with bolts, H. C. I. double junction with door, Single and Double junction without door, H. C. I. inverted junction, H. C. I. bend, H. C.I. bend with door, H. C. I. heel rest bend, H. C. I. offset and shoe, C. I. 'P' trap, C. I. inspection pipe, C. I. trap connection pipe (plain), H. C. I. Bell mouthed 'P' trap, C. I. vent cowl, Fresh air inlet valve, H. C. I. Tee.

(b) Asbestos pipes:

Fittings—Same as above viz., Bend, Tee, Junction etc.

(c) Stone-wave pipe:

Fittings—Bend, Tee, Junction etc.

Jointing material:

Make joints with jointing materials as follows:

(i) Joint between C. I. pipe and A. C. pipe with gasket and cement.

(ii) Joint between C. I. pipe and C. I. pipe with gasket and molten lead.

(iii) Joint between Lead pipe and C. I. pipe—Iron end with brass sleeve set with gasket and molten lead. Brass sleeve end and lead pipe with wiped lead joint.

(iv) Joint between C. I. and Stone ware pipe with gasket and cement.

2. Fitting fixing of C. I. pipe and C. I. fittings.

Fix 4″ dia H. C. I. soil pipe in wall with bobbins and nails for two lengths with lead caulked joints. Fix C. I. single branch equal and make lead caulked joints.

Make 'P' and 'S' trap connection with 4 inch dia H. C. I. soil pipe and make connection with 2″ dia. anti-syphonage pipe.

3. Laying and jointing of stoneware pipe.

Materials and equipments.

Timber side posts, Tiber sight rails, Bonning rod with shoe dumpy level, Staff, Stand, Pegs and arrows, Tape stone over pipes, cement mortar, gasket.

Excavate a small trench and its base may be concreted after making slope in the foundation bed through S. W. pipes may be laid and cement joints with gasket. The slope of pipes may be checked by boning rod.

Make a small brick paved platform and over it make connection of S. W. bend, T and Y connection. From Y junction lay a small S. W. pipe line jointed with gasket and cement and connect it with a yard gully. While laying pipe for connecting yard gully the slope should be towards Y junction.

In the pipe line laid in slope by bonning rod as explained above connect with a master trap. Similarly make connection with 'P' and 'S' traps etc. in a separate S.W. line.

4. Fixing of water closets etc.:

Fitting and fixing of the following with P and S trap connection :

(i) White glazed Indian pattern W.C. Pan.

(ii) White glazed (Orissa) type W.C. Pan.

(iii) White glazed European pattern W.C. Commode.

(iv) White glazed Anglo-Indian pattern W.C.

Use white glazed trap—'P' and 'S'.

Use jointing material—cement mortar and gasket.

Fitting or fixing of white glazed flat back, and corner standing urinal in wall with water pipe connection. (Polythene).

Examine the following :

Lid of closet with C.P. hinges, rubber buffer and brass screws :

(a) E.P.W.C.
  (i) Teak wood ;
  (ii) Bestolite (Black).
  (iii) Bestolite (White).

(b) Anglo Indian—Teak wood.

Closet seat with lid and C.P. hinges, rubber buffer and brass screws :

(a) E.P.W.C.
  (i) Teak wood.
  (ii) Bestolite (Black).
  (iii) Bestolite (White).

(b) Anglo Indian—Teak wood.

Demonstrate white glazed half round channel for urinal.

5. Study of Models of Septic tank etc.

(a) Septic tank

Make a model of Septic tank and demonstrate the following: Inlet pipe—'T' section, Hanging baffle, Standing baffle, Scum board, outlet pipe, Scum level, Sump, clear space between scum level and top of slab, vent pipe, C.I. covers etc. specifically mention necessity of different chambers.

(b) Sewer appurtenances :

Study the modes of the following :

Manholes, Lamp holes, Drop manhole, Inlets, Catch basins and traps, Flushing tanks, Outlets, etc.

C. Survey Practical

Introduction :

Demonstration of the following :

(a) Linear measuring instruments :

Pegs, Flags, Coloured rods, chains (Engineer's, Gunters'), arrows, Tapes, Offset rods, Steel-Band, Steel tape.

(b) Instruments for determining direction :

Cross-staff, Optical square, Prismatic compass, Sextants.

(c) For determining elevation and depression of the earth surface etc.

Demonstrate to check the length of a chain.

Demonstrate how to use the chain.

Ranging of a line by ranging rods.

Unfolding and Folding the chain.

1. Chain Survey

(i) Instruments for chain survey :—Chain, arrows, tape, ranging rods, optical squares and some pegs and a hammer.

(i) Preliminary operations :—A rough sketch should be prepared noting all roads, houses, streams, etc. Then on the rough sketch triangles are to be drawn. Intercepting point of all triangles should be numbered. These are called Station points.

Fixing of Station points and North line to be drawn on the sketch.

(iii) Measuring the lines—Work is to be carried out from whole to the part and not from part to the whole i.e. the work must be from the boundary lines towards the interior and not from the interior towards the boundary.

(iv) Method of chaining—After the line is measured the measurements would be noted in the field book. Either in right or in left of the chain line, if there be any objects, the perpendicular measurements must be taken and noted in the field book.

(v) Field book—Nothing should be commenced from the bottom of the last page of the book and will continue through its successive pages.

(vi) Oblique offset—Where perpendicular measurement is not possible owing to some obstruction.

(vii) Instruments for taking offset :

Tape, offset rods, cross staff, optical square.

(viii) Obstacles in Chain surveying :

Obstacles such as ponds, tanks, houses etc., all these obstacles can be avoided by making right angles with the chain line.

Complicated problems should not be taught. The students should only know very simple cases as above.

(ix) Method of Plotting:

Explain in detail the method. Students should do the chain survey of a small plot and they should prepare a plan with proper plotting.

North line and Scale should be drawn on the map.

2. Levelling:

Demonstration:

(i) Explain in detail all parts of the dumpy level and accessories of levelling operation viz. staff etc.

(ii) Temporary adjustment of Dumpy level.
Every student should do this adjustment.

(iii) Method of levelling: Level should be placed midway between two extreme points in one setting. Before taking reading the staff should be waved to and fro.
Back reading, Fore reading etc.

(iv) Find the difference of level between two points. Explain Datum, Reduced level, Bench mark.

(v) Precautions necessary before and during the use of level.

(vi) Recording in Level Book by Rise and fall method.

(vii) Taking of levels and recording in field book along a road alignment and draw longitudinal section.

3. Setting out of a Small building:

Prepare foundation plan first. Such a plan shows the foundation widths of different walls and correct distance between their centre lines.

Operations:

(1) Cut out the trees and clear the shrubs from the proposed site and dress up the heaps and deeps if any.

(2) Lay out the centre length of an exterior wall as per plan. Preferably start with a long wall. Stretch a strong cotton or silk cord with stout pegs at the extremeties. Drive the pegs at 4 ft. from the extreme edge of cutting.

(3) Fix up the position of the corners by two temporary pegs with nail points on their heads at specified distance. Through these corner points stretch two strings for side walls at right angles to the existing line with the help of a Mason's square, Builder's level, or by Chain angle method. Measure and fiix pegs at the other two corners.

(4) Thus after completing the biggest rectangle, check the diagonals. If there is any wrong adjust.

(5) The biggest rectangle being set out correctly, fix up other pegs at junctions of cross wall.

(6) Now, set up the lines demarcating the edge of cutting for all the walls. Mark these lines by 'Dag-Bell' and if possible spade out from the foundation strips a thin layer of 6″ earth for guidance of earthwork. Thus the ground-tracing of the building is completed.

Materials and Instruments required for setting out the building :

1. Stout wooden pegs or stakes 12″ to 24″ long and 1½″ to 2″ square or round in section with squared top and pointed bottom.
2. One jumper and a hammer.
3. 1″ wire nails, fine but strong cotton or siik cord and coir rope.
4. A 100 ft. metallic tape and a steel band or a 100 ft. steel tape.
5. A mason's square and a levelling instrument and a pointed or 'Centre-plumbob'.
6. Other miscellaneous tools or equipments viz. spade, axe, buckets, pans etc. and materials for building the brick pillar.

PARA-MEDICAL

Part A

GENERAL PHARMACY

1. Acquaintance with common procedures and equipments in manufacturing pharmacy, like Grinding, Sieving, Mixing, Granulating, Drying, Tabletting, Capsuling, Sterilizing, Bottling, Sealing and Packaging machineries.
2. Preparation of Tinctures like Tincture of Hyocyamus, Ginger, Cardamom Co.
3. Liquid extracts of Ipecac, Senna, Bael/Kalmegh etc.
4. Preparation of ointments like Sulphur, Boric acid and Zinc oxide.
5. Preparation of Tablets of Aspirin, Soda-mint and Milk of magnesia.
6. Capsule (hand-filling) of any antibiotic.

Part B

DISPENSING PHARMACY

1. Reading and planning for dispensing doctor's prescriptions including common calculations for required doses and directions for use.
2. Dispensing powders containing Sulpha drugs, Aspirin, Phenobarbitone, Phenolphthalein, Antibiotics, Alkaloids ets.
3. Preparation of effervescent granules.
4. Castor oil emulsion.

5. Non-staining iodine ointment containing methyl salicylate, Ophthalmic eye ointment containing antibiotic, Acriflavine ointment.
6. Eye lotion containing Boric acid and Zinc sulphate.
7. Ampoules (sterilized) of water for injection, 5 p.c. dextrose solution.
8. Prescriptions serving with directions :

i. Quinine hydrochloride		gr. ii
Sodi salicylas		y i
Aq.	ad	iii

M. F. Mist. One Table spoonful after meal, twice daily.

ii. Sodi salicylas		5 gm.
Syr. limonis		20 ml.
Aq.	ad	75 ml.

M. F. Mist. 15 ml. with cold water thrice daily.

iii. Totaquin.	5 gr.
Quinine sulphate	3 gr.
Ammon. Chlor.	2 gr.
Tinc. Card Co.	2 m.
Aq.	1 oz.

M. F. Mist. Send 6 such doses : Direction 2 doses daily.

iv. Sodi bicarb		15 grs.
Spt. Ammon aromat		15 m.
Spt. Chloroform		10 m.
Tinct. Card. Co.		10 m.
Water	to	1 oz.

Prepare 4 doses.

v.	Kaolin	30 grs.	
	Bismuth card	30 grs.	
	Syr. Ging.	30 m.	Prepare 6 doses, thrice
	Aq. Menth Pip ad	1 oz.	daily.
vi.	Sodi bicarb.	0.3 gm.	
	Potas Iod.	0.3 gm.	
	Ammon. Carb.	0.25 gm.	Prepare 6 such doses.
	Syr. Tolu	0.2 ml.	
	Tinct. Card. Co.	0.1 ml.	

Students should know the conversion factors and ratios of both metric and old Apothecary systems and calculations for multiple doses. They should be familiar with preliminary instructions about incompatibilities.

Part C

PHARMACEUTICAL CHEMISTRY

1. Volumetric titration involving acid and alkali estimation; role and signification of indicators : Iodine-thiosulphate and Permanganate titration, Oxidation and Reduction value are to be calculated by simple examples in practical classes ; I. P. directions are to be followed and necessary explanations are to be given.

2. Determination of pH. values through coloured standard solutions like Bromothymol Blue, Methyl Red, Phenol Red, Thymol Blue etc. or with Indicator papers.

3. Estimation of sugars with Fehling/Benedict method.

4. Qualitative tests for Proteins with Nitric acid (Xanthoproteic), Ninhydrin solution.

5. Qualitative test for alkaloids with Meyers/Dragendorff reagents.

Part D

PHARMACOLOGY

1. Effect of Chloroform/Ether whiffs on mica ; anasthesia and recovery time are to be noted :

2. Effect of Diastase solution (Taka diastase) on 1 p.c. solution of soluble starch is to be noted : 1 pc. solution of enzyme is to be mixed with 5 c.c. of soluble starch at pH. 5.5 and incubated for 15 to 30 minutes and development of colour after addition of iodine solution (dilute) is to be observed vis a vis untreated starch soln :

3. Effect of proteolytic enzymes (eg. Pepsin, Papain/trypsin) on coagulated egg albumin (in small pieces or granules) at suitable pH.s (2.0, 5.5, 8.0) with 1 p.c. enzyme soln. is to be observed.

4. Demonstration of heart rate and effect of stimulants (adrenalin) on frog's exposed heart experiment :

   Demonstration and explanation of Blood pressure (individual students) with the help of Blood Pressure instrument (Spyngomanometer).

5. Demonstration of inhibition of bacteria by antibitics (like Penicillin or Streptomycin or Tetracyclines) by Turbido-

metric and Cylinder-Plate method : Teacher should explain the importance of antibiotics both for Gram-positive and Gram-negative infections.

6. Demonstration of Widal Agglutinin reaction with standard sera and suspension of Typhoid, Paratyphoid killed organisms ; Teacher should explain the phenomenon in terms of immune reactions of natural systems.

Part E

PHARMACOGNOSY

1. Inspection and notebook preparation of crude drugs like, Nux Vomica seeds, Digitalis leaves, Belladonna roots, Cinchona barks, Senna pods, Ipecac roots, Orange peels, Coriander seeds, Ephendra herbs (dried) and Cardamom fruits.
2. Submission of at least Six herbarium sheets containing locally available drug samples including their uses : Vasak, Kalmegh, Ginger, Kantikari, Bael, Anantamul, Rawolfia, Ajowan, Kulekhara, Khetpapra, Chhatim, Neem, Nayantara, Arjun, Aswgandha, etc. with their botanical names etc.
3. Examinaiton with the help of magnifying glass and low-power microscope the characters of representative samples of roots, flower, stem, bark, leaves etc.
4. Institution should maintain a museum containing all available drugs, illustrations and natural sources along with their active principles and medical uses.

REFERENCES FOR THE MULTIPURPOSE HEALTH WORKERS COURSE

(a) Individual Health, Care and diseases.

References :—

(1) Nursing Procedures—

West Bengal Nursing Council.

Chapter 5—Page 17-33

Chapter 17—Page 107-122

Chapter 19 & 20—Page 134-155
Page 156 (only ice cap).

Chapter 22--Only Cold and tepid sponge.

Chapter 23, 24 & 25—Page 164-172.

Chapter 26—Oxygen in lalation.

Chapter 13—Page 19.

Chapter 30—Page 245-249 (only Catheterisation).

(2) সেবা ও শুশ্রূষা—পশ্চিমবঙ্গ নার্সিং কাউন্সিল কর্তৃক প্রকাশিত।

(3) Report of the Committee on Multipurpose Workers under Health & Family Planning Programme, Govt. of India—Page 17.

(4) Study Guide for Auxiliary Nurse Midwives—Published by W.H.O., Regional Office for South East Asia.

(b) General Care of the sick

(i) First Aid and Home Nursing—by Red Cross Society.
Publisher : St. John Ambulance Association,
1, Red Cross Road, New Delhi.

(ii) Medicine for Nurses—W. Gordon Sears.
Publisher : Orient Longmans,
Page 17-37 and related chapters.

(The contents of this chapter are to be worked out keeping in mind the time available and responsibilities to be encountered).

Related Study : Anatomy & Physiology by Evelyn Pearce.

(iii) Nursing Procedures—West Bengal Nursing Council.
Page 224, 230-231.
Page 93, 98.
Page 197, 199, 201.
Page 273-282 and
Chapter 34. Page 283-301.

(c) Nutrition :—

(i) Nutritive value of Indian Foods—
by C. Gopalan, Ramsashtri & Bala Subramaniam.

Published by :

National Institute of Nutrition,
Indian Council of Medical Research,
Hyderabad, India.

(ii) Our Food—Swaminathan & Bhagavan,
(Publishers : Ganesh & Co., Madras).

(iii) A hand book of Preventive & Social Medicine
—Dr. S. L. Roy.
Academic Publishers.
Chapter 10, Page 206-252.

(iv) পুষ্টির অভাবজনিত রোগের প্রতিরোধের উপায়
—Dr. H. C. Mookherjee Memorial Health School, Singur কর্তৃক প্রস্তুত ও প্রচারিত।

(v) Hygiene & Public Health—Dr. B. N. Ghosh.
Scientific Publishing Co. Page 162-244.

(d) Community Health :

(i) A hand book of Preventive & Social Medicine
—by Dr. S. L. Roy.
Academic Publishers—Chapter 15, Page 300-317.

(ii) A hand book of Hygiene and Public Health by—Y. P. Bedi. Anand Publishing Co., Amritsar, Chapter XX—Page 356-376.

(iii) Multipurpose Health Workers Scheme.
Published from the Office of the C.M.O.H., Government of West Bengal.

(iv) Text book of Community Health for Nurses.
J. E. Park (Asrani Publishers : 242, Bharatpur, Jabbalpur.)

(e) Communicable diseases, their control and eradication :

(i) A hand book of Hygiene and Public Health.
—Y. P. Bedi—Ch. XV—Page 258.

(ii) A hand book of Preventive & Social Medicine
—Dr. S. L. Roy.

(iii) Hygiene & Public Health—Dr. B. N. Ghosh Scientific Publishing Co. Section XXIV/XXIX Page 345-600.

(f) & (g) Refer books above.

(h) Refer books above and Nursing Procedures—Published by the W. B. N. C.

Mother & Child Health Care & Family Planning

(i) A text book of Midwifery for Nurses in India —by L. M. Barker. Publishers: Orient Longmans.

(ii) ধাত্রী বিদ্যা—
Dr. R. Gupta. Academic Publishers.

(iii) Nursing Procedures—West Bengal Nursing Council.
Chapters 36, 37 and 40.
Page—318-350, 351-389 and 397.

(iv) Child Health Care in Rural Areas—A manual for Auxiliary Nurse Midwives—Published for Rural Health Research Centre—by Asia Publishing House.

ELECTRICAL AND ELECTRONIC TRADE

BASIC THEORY

PAPER—II (Marks 50)

(Total hours in Class XI & XII—100)

In this guideline, the following steps have been followed to clarify the goals of the syllabus for the purpose of teaching.

a. The syllabus is broken up into details and then properly sequenced for the convenience of teaching.

b. There are two major divisions showing the contents to be covered in Class XI and Class XII.

c. Each topic heading gives reference to numbered items as appeared often in a different sequence, in the syllabus, (p. 79) for vocational stream courses.

d. The details of each topic gives suggested depths and nature of treatment with examples.

e. Each sub-topic indicates contact hours for the adequate coverage and practice of the material. A minimum of only 45 hours in Class XI and 55 hours in Class XII is assumed for the subject, allowing for late admission, disturbances, need for revision and further practice etc., since, in a vocational course, the entire part of the syllabus is important. 3-hours are kept aside for class tests in each year.

f. Reference books, chapter/page Nos. have been given along with each topic. The number within bracket indicates the serial number of the list of books shown in the end.

CLASS XI

Unit No.	Topic/Sub-topic	Hours
1.0	Fundamentals of Electricity and the Electron theory (Total hrs. 6 syllabus ref. Para 1)	
1.2	Examples of Atomic structures with diagram. Explaining atomic number and atomic weight. Isotopes and radio activity may be touched upon as examples.	1
1.2	Elementary idea of shells, valency electrons and free electrons.	1
1.3	Explaining conductor, semi-conductor and insulator by diagram of energy band, i.e. filled, forbidden and empty bands.	1
1.4	Charge of an electron. Defining Coulomb and stating Coulomb's Law in S.I. Units. Explaining permitivity with examples. Value of permitivity of free space in the S.I. Units.	1
1.5	Explaining electric lines of force and electric field with diagram. Explaining potential and potential difference. Defining volt. Defining capacitance. Finding capacitance of parallel plates. Relative permitivity.	1
1.6	Defining current flow. Physical concept of current flow, comparing velocity of current wave with the drift velocity of electrons in metals. First hand idea of conduction through electrolytes and gases.	
2.0	Electric Circuit (Total hrs. 13, Syllabus ref. Para 1, 2, 6)	
2.1	Components of a practical electric circuit. Source, sink, ideal conductor, switch defined. Circuit symbols as per I.S.	1

2.2 Ohm's Law defined and explained with demonstrations and numerical examples. Simple problems. ... 1

2.3 Resistivity and law of resistance explained with examples. Simple problems on voltage drop, material and size of wire.

2.4 Deduction of formulas and problems on series and parallel circuits to find voltage, current power. Explaining conductance of parallel paths. ... 2

2.5 Explaining applications of series and parallel circuit. Basic principles of extension of instrument range. Regulating and diverting resistance to control voltage/current in a circuit. Examples of series rheostat, potentiometer box, fuse, galvanometer shunt, series, parallel control of heating coils in an oven. Explaining resistance-temperature co-efficient. 2

2.6 Explaining the heating effect of electric current. Defining resistance as a heat producing property, simple problems of electrical heating in S.I. Units. ... 1

2.7 Explaining S.I. units of work, energy, power. Explaining input, output, efficiency. Problems on electro-mechanical energy conversion, e.g. power of a lift motor, work done/electricity consumed by a pump, fuel consumed by a power house. 2

2.8 Explaining Kirchhoff's Circuit Laws. Solving problems on simple series parallel, bridge, and 3-wire supply circuits. 2

2.9 Explaining other effects of electricity. Magnetic, chemical, pieze electric, bimetal junction. ... 1

3.0 Magnetic field. Electromagnetism. (Total hrs. 10, Syllabus ref. Para 1, 3).

3.1 Explaining magnetic field. Defining flux, permeability, reluctance, field strength, flux density (concept of unit magnetic pole should not be introduced). Explaining units and formulas in S.I. units for mmf, reluctance and flux in the case of a toroid and long solenoid, with the analogy of electric circuit. 2

3.2 Problems on field produced by electric coils. Finding direction of field, field around a straight conductor by applying the mmf rule in a closed path (Amperes Law). ... 1

3.3 Force on a current carrying wire in a magnetic field. Physical concept and rule for finding direction of force. Finding force between two parallel conductors. Value of permeability in free space. Definition of ampere in SI units. 1

3.4 Magnetic materials. Defining dia-, para- and ferromagnetism. Magnetisation curve, illustration for various samples of iron and steel. Explaining hyoteresis and hysteresis loop, residual magnetism, coercive force. Examples of materials for permanent magnets. Magnetisation and demagnetisation. 2

3.5 Construction of an electromagnet. Explaining use and effect of airgap. Concept of leakage flux in a magnetic circuit. Calculation of mmf, flux etc. in a core with or without airgap. 2

3.6 Explaining the working principle of simple electromagnetic devices, e.g. Attracted armature type and solenoid plunger type relays, lifting magnets. ... 2

4.0 Producing electricity

(Total hrs. 13,
Syllabus ref. Para 3, 8)

4.1 Explaining/demonstrating the electromagnetic induction, self-induction and mutual induction. Applying Faraday's Law and Lenz's Law to find magnitude and direction of induced emf by a moving conductor in a magnetic field, and a stationary coil with varying flux linkage. Demonstration of right hand finger rule and right hand palm rule. 1

4.2. Explaining the basic principle of electro-mechanical energy conversion by relating force and mechanical work done on a conductor carrying current in a magnetic field, and the induced emf of the moving conductor. Problems on force, power, and length of conductor moving in the magnetic field. 2

4.3 Explaining the working principles of eddy current breaking, induction furnace. Effect of making and breaking a circuit containing field coils. 1

4.4 Finding voltage across the two ends of a rectangular coil rotating in a uniform magnetic field, at different instants. Explaining principle of commutation and function of brush Vs. slip rings. Describing the advantage of multi coil armature. Explain construction of a. d.c. generator with the help of a schematic diagram, and naming of essential parts. 2

4.5 Explaining the different connections of self-excited generators and effects in respect of induced emf at various leads, armature voltage drop, etc. 2

4.6 Principle of d.c. meters and comparison with generators. Relation of torque and speed with the back emf and current in S.I. units. ..., ... 2

4.7 Explaining principle of action of primary cells. Illustrating emf obtained in a cell with dissimilar electrodes. Construction of Dry cell and explaining arrangements to prevent local action and polarisation. Description of a standard cell. 2

4.8 Brief notes on the principle of thermocouple generator, solar cell and fuel cell, explaining materials used and action. 1

CLASS XII

Unit No.	Topic/Sub-topic	Hours
5.0	A.C. Principles	(Total hrs. -16. Syllabus ref. Para -4)
5.1	Plotting of instantaneous values of emf induced in a coil rotating in an uniform magnetic field at a constant speed. Defining cycle, frequency, time period. Essential parts of a single phase alternator. Relation between speed, frequency and number of poles.	1
5.2	Explaining concept of phase and phase difference with the example of two coils shifted by an angle on the axis, rotating at the same speed. Trigonometric expression of sinusoidal a. c. voltages at different phases.	1
5.3	Adding two voltages in different phases by analytical method and by geometrical method, or phasor diagrams, to find the total voltage (maximum value and phase)	1
5.4	Demonstrating the heating effect of a.c. and defining the effective or rms value. Finding rms value of a sinusoidal a.c. quantity.	1
5.5	—Deriving mathematical expression of an a.c. quantity from the given frequency, rms value and phase and vice versa. Different ways of denoting a.c. quantities.	1
5.6	A.C. circuit with resistances. Comparison with the d.c. circuit. Concept of average power consumed, and its relation with the rms current and voltage of the circuit.	1
5.7	Explaining the phenomena of stored energy in the electric and magnetic fields with mechanical analogy. Defining inductance.	1

5.8 Steady state alternating current through a pure inductance. Explaining concept of leading or lagging voltage. Finding inductive reactance. 1

5.9 A.C. voltage across a capacitance. Finding capacitive reactance. 1

5.10 A.C. series circuit having capacitance and inductance. Comparison with d.c. circuits. 1

5.11 A.C. circuit with resistance and reactance. Concept of impedance and impedance triangle, solving simple a.c. series circuits. 2

5.12 Finding power in an a.c. circuit having reactance. Defining and finding power factor of mixed resistive/reactive loads. 1

5.13 Solution of parallel a.c. circuit having resistance and inductance in one branch and capacitance in the other. 1

5.14 Defining resonance. Relating frequency, inductance and capacitance for series and parallel resonance. Comparing series and parallel resonance. Finding the frequency of an oscillatory circuit. Explaining principle of tuning in a radio. Defining and finding the factor of a coil. 2

5.15 Charging and discharging of a capacitor. Rise and decay of current in an inductive coil. Finding time constant of a circuit. Formulas and graphical illustrations. Examples of triangular, square ac waves, pulses, and explaining how these are produced. ... 1

6.0 Mutual inductance and transformer.
(Total hours : 5, syllabus ref. para 12).

6.1 Explaining principle of operation of an ideal transformer by mmf rule, i.e. $N_1 i_1 = N_2 i_2$, and conservation of energy, i.e. $E_1 i_1 = E_2 i_2$, and finding turn ratio. ... 1

6.2 Defining mutual inductance and co-efficient of coupling. Explaining stored energy in mutual field and energy transformer from one coil to the other. ... 1

6.3 Deducing emf equation for given flux and frequency. Explaining step up/step down transformer, presence of no load current in the primary, purpose of laminating the core. 2

6.4 Principle of auto transformer and tap changing. ... 1

7.0 Rectification.
(Total hrs.-4, syllabus reference, para 11).

7.1 Explaining the advantage of ac and the need for rectifier, and advantage of static rectifier over motor-generators. 1

7.2 Description and principle of action of copper oxide, selenium and semiconductor rectifiers. Describing construction of rectifier stacks. 1

7.3 Rectification circuits for half wave and full wave rectification, and smoothering the out-put voltage. Circuit diagram of a battery eliminator. 1

7.4 Explaining construction and principle of action of a vacuum tube and gas filled diode. 1

8.0 Measurements and measuring instruments.
(Total hrs.-19, syllabus ref. para 5, 13).

8.1 Describing the components of the moving system of an indicating instrument, and its functions. ... 1

8.2 Explaining accuracy, sensitivity, precision, reliability of an instrument. Classification and symbols as per IS 1248. 1

8.3 Construction and principle of operation of permanent magnet moving coil instrument, and showing its use as dc galvanometer, ammeter and voltmeter. Finding deflecting torque. 2

8.4 Construction and principle of operation of moving iron instruments and its use in ac and dc. 1

8.5 Construction and principle of action of dynamometer type wattmeter for use in ac and dc. 1

8.6 Construction and principle of dc ampere hour meters. Contrasting the mechanism of integrating instrument with the indicating instrument. 1

8.7 Construction and principle of single phase ac house service meters.

8.8 Construction of hot wire instruments, thermo couple instruments, platinum resistance thermometers, speedometers. 1

8.9 Describing use and construction of megger and ohmmeter. Describing schematic circuit arrangement of a multimeter (AVO). 2

8.10 Connection of instruments in ac and dc panels. Use of ammeter shunts and current transformers. ... 1

8.11 Measurement of resistance by ammeter-voltmeter method, and errors due to connection. ... 1

8.12 Explaining Wheatstone bridge principle. Describing use of P.O. Box and metre bridge to find unknown resistance. 2

8.13 Principle of potentiometer. Explaining use of potentiometer for measuring voltage, current, by using a standard cell and standard resistance. ... 2

8.14 Discussing elementary idea of measurement with ac bridges in comparison with dc bridges. Formula and circuit of maxwell and schering bridges. ... 2

9.0 Electrolysis, Accumulators,
(Total hrs.-8, syllabus ref. para 7, 8).

9.1 Explaining the mechanism of electrolytic or ionic conduction in contrast with the electronic conduction in metals. Explaining dissociation of acids, bases and salts in solution. Description of electrolysis of water, and copper sulphate with carbon and copper electrodes. 1

9.2 Explaining Faraday's Laws of electrolysis with examples. Defining electrochemical equivalent. Finding quantity of metal deposited from the given E.C.E., current and time. Relating E.C.E. with atomic weight and valency. 1

9.3 Description of nickel plating, electro-forming of grammophone records, electrolytic refining of metals and manufacture of aluminium from fused bauxite. ... 1

9.4 Principle of a storage cell. Distinguishing between primary and secondary cells. Explaining chemical changes in lead-acid accumulator during charging and discharging. 1

9.5 Description of the construction of a lead acid cell. Construction and assembly of plates. 1

9.6 Charging of a lead acid cell. Description of circuit, finding polarity, state of charge, capacity of a cell. ... 1

9.7 Precautions in using a lead acid cell. Explaining cause of common defects. Describing a battery room in a sub-station. 1

9.8 Describing construction and use of nickel-iron alkali cells, and their advantages/disadvantages over lead acid cells. 1

BOOK REFERENCES

UNIT 1.0	1, Vot—I, P. I—36. 2, Chap.—I. 5, Chap.—1. 4, Chap.—1. 5, Chap.—1. 6, Vol—I.
UNIT 2.0	1, Vol—I, P. 45—65. 1, Vol—II, P. 1—53. 7, Vol—I. 3, Chap.—2
UNIT 3.0	1, Vol.—I, P. 66—100 3, Chap.—5.
UNIT 4.0	1, Vol. I, P. 37—44 3, Chap. 6, P. 149—153 Chap. 3, P. 102
UNIT 5.0	3, Chap. 7, P. 167—186 1, Vol.—III 6, Vol.—IV 7, Vol.—II
UNIT 6.0	3, Chap.—9, P. 233—255
UNIT 7.0	3, Chap.—13, P. 329—345
UNIT 8.0	3, Chap.—14, I.S. 1248, 1, Vol.—V
UNIT 9.0	3, Chap. 3, P. 94—112, Chap. 16, P. 432—438.

ELECTRICAL AND ELECTRONIC TRADE
BASIC THEORY

List of Books

*1. Basic Electricity Vol. I, II, III, IV, V, VII
Harry Mileaf—Editor-in-chief.
D. B. Taraporevala & Co. Pvt. Ltd.,
Bombay.
(Price Rs. 5.50 to 6.40 each)

2. Basic Electricity (5 parts)
Van Valken Burgh, Nooger & Neville, Inc.
Asia Publishing House.

*3. Fundamentals of Electrical Engineering,
M. Kuzhetsov Poace Publications, Moscow.

4. Basic Electricity, Theory and Practice.
Milton Kanfman, J. A. Wilson.
McGrow Hill.

5. Elements of Electrical Engineering—A Text Book for technical schools, NCERT,
Delhi.

6. Audel's New Electric Library,
Vols. 1, 2, 3, 4.
D. B. Taraporevala & Co. Pvt. Ltd.,

7. Basic Radio, M. Topper, Vol. 1, 2 (Rs. 2.00 each), Taraporevala.

* Recommended text books.

Vocational Stream Courses—Para Medical

Guidelines on Medical Laboratory Technology

The syllabus of the Medical Laboratory Technology is mainly designed to prepare the students to undertake the common laboratory procedures used in the diagnosis and treatment of patients. It is, however, necessary that the student should be acquainted with the principles of the method as well as the method itself. A basic level understanding of physics, chemistry and biology shall provide the necessary background for a fuller appreciation of the rationale of the laboratory methods. This will enable him to interpret the results of the tests performed by him. A critical appreciation of the methods will enable him to understand the limitations of each of the methods and provide him with the necessary perspectives of his subject.

In the absence of suitable textbooks on the subject, the guideline is prepared in the form of questions (a) essay type, (b) short notes, (c) objective type, so that the teacher will be able to help the students by collecting relevant material from various source books, some of which are of higher standard than required for the higher secondary education level of the West Bengal Council. A list of books have been suggested for the teachers which may be helpful and relevant.

Bacteriology

1. Write a short account of morphology of bacteria.
2. Write a short account of the neutritional requirements of bacteria.
3. What is meant by sterilisation and disinfection? Write a short account of the methods used for sterilisation.
4. Write a short account of the common staining procedures used in a bacteriological laboratory.

5. Describe the steps involved in the identification of bacteria.

6. Write short accounts of laboratory diagnosis of
    - (i) Liphtheria.
    - (ii) Typhoid.
    - (iii) Cholera.
    - (iv) Bacillary dysentery.

7. What is antibiotic sensitivity test. Describe the principles of the test.

8. Give a short account of the classification of bacteria.

9. Write short notes on :
    - (i) Nutrient agar media.
    - (ii) Blood agar media.
    - (iii) Loeffler's media.
    - (iv) Lowenstein Jensen Media.
    - (v) Robertson's Cooked meat media.
    - (vi) Anacrobiosis.
    - (vii) Gram's stain.
    - (viii) Zichl-Neelsen stain.
    - (ix) Staphylococcus.
    - (x) Streptococcus.
    - (xi) Viable count.
    - (xii) Bacterial spores.

10. Briefly describe the procedure for bacteriological culture and sensitivity test of
    - (i) Urine.
    - (ii) Blood for blood culture.
    - (iii) Throat swab.

11. Fill up the gaps :
    - (i) Acid fast organisms are stained red by —.
    - (ii) In Gram's staining — is used as a mordant.
    - (iii) Loeffler's medium is sterilised by —.

(iv) pH of alkaline peptone water is ——.

(v) —— is a selective medium for the cultivation of corynebacterium.

(vi) Glasswares are sterilised in the hot air oven at a temperature of ——

(vii) Agar melts at —— °C and solidifies at —— °C.

(viii) Metachromatic granules can be demonstrated —— stain.

(ix) Autoclaving is usually done at a temperature of ——

(x) Sugar media are sterilised by ——.

(xi) If iodine solution is not used for mordanting, a Gram positive organism may appear as ——.

12. Put a tick (√) against a correct statement and a cross (×) against an incorrect one.

(i) No chemical disinfectant can kill bacterial spores ( ).

(ii) All capsulated organisms are non-motile ( ).

(iii) Heated air being lighter than steam will escape through the opening in the lid of an autoclave ( ).

(iv) Salmonella typhi produces H_2S in triple sugar vion media ( ).

(v) A vibrio which gives positive cholera red reaction is certainly a cholera vibrio ( ).

(vi) Meningitis may be caused by gonococcus ( ).

(vii) Clostridium welchii produces exotoxin ( ).

(viii) Clostridium tetani grows only under anacrobic condition ( ).

(ix) In clostridia, the spores are contained entirely within the body ( ).

(x) Gonococci should be cultivated in an atmosphere of 5-10% CO_2 ( ).

(xi) Guineapigs inoculated with materials suspected to be containing Mycobacterium tuberculosis should be observed for 3 week ( ).

(xii) Mycobacterium leprae cannot be cultured in cell-free medium ( ).

Serology

1. Enumerate different types of antigen-antibody reactions and explain each reaction with examples.
2. Describe the serological diagnosis of typhoid fever.
3. Explain the principles of Serological reaction used in the diagnosis of syphilitic infection in man.
4. What do you understand by the 'titre'? Describe how you will find out the H-agglutinin titre of salmonella typhi anti-sorum.
5. What is an antigen?
6. What is an antibody?
7. Write short notes on
    - (i) Immunity.
    - (ii) Serology.
    - (iii) Immunology.
    - (iv) Complement.
    - (v) Agglutination.
    - (vi) Precipitation.
    - (vii) Complement fixation.
    - (viii) Neutralisation.
    - (ix) Opsonin.
    - (x) Amboceptor.
    - (xi) Hapten.
    - (xii) Hypersensitivity.
    - (xiii) Aldehyde test.
    - (xiv) Chopra test.
    - (xv) Rose-waaler test.
    - (xvi) Weil-Felix reaction.
8. Describe the principle of agangel diffusion.

Clinical Pathology including Parasitology

1. How would you proceed to examine a sample of faeces in the laboratory? Enumerate the file stained ova found in faeces. Draw diagrams and label.

2. State the method commonly employed as concentration test for detection of helminthic ova in faeces.

3. Give a short account of
    (i) hookworm (Ancylostoma duodenale and Necator americanus).
    (ii) round worm (Ascaris lumbricoides).
    (iii) threadworm (Enterobins vermicularis).
    (iv) Entamoeba histolytica.
    (v) giardia (Lamblia intestinalis).
    (vi) malaria parasites.
    (vii) microfilaria of Wuchereria bancrofti.
    (viii) Leishmania donovani.

4. Write short notes on
    (i) Benedicts' reagent.
    (ii) Charcot Leyden crystals.
    (iii) Occult blood test.
    (iv) Urobilinogen.
    (v) Fouchet's reagent.
    (vi) Rothera's test.
    (vii) Bence-Jones proteinuria.

5. What do you mean by glycosuria? How would you proceed to establish your diagnosis?

6. Describe briefly how would you proceed step by step in the routine examination of a sample of urine. If glycosuria is detected, how would determine it quantitatively!

7. Describe a common laboratory microscope. Draw a diagram and label its various parts.

1. What are the constituents of blood ?

2. Give an outline of the origin and development of blood cells.

3. What are the common anticoagulants used in haematology laboratory ?

4. What are the different methods for the determination of anaemia.

5. What are the principles of haemoglobinometry. Describe one method commonly used for the determination of haemoglobin and discuss its limits of accuracy.

6. Give a short account of the stains used for blood and bone-marrow smears.

7. Describe how blood clots.

8. Write a short account of the methods for the study of haemoglobin variants.

9. Write short notes on
   - (i) M.C.V.
   - (ii) M.C.H.C.
   - (iii) M.C.H.
   - (iv) Packed cell volume.
   - (v) Reticulocyte.
   - (vi) Incomplete antibodies
   - (vii) Antiglobulin test
   - (viii) L.E. Cell phenomenon
   - (ix) E.S.R.
   - (x) Crossmatching.

10. What are the different possibilities of ABO blood Group of children born of Group A father and Group B mother. Answer with the aid of a diagram.

11. Tick (√) the correct answer on answers

(i) Indirect antiglobulin (Coombs') test is performed to detect
  (a) if the red cells are sensitized by antibody
  (b) the presence of 'incomplete' antibody in serum
  (c) the presence of 'complete' antibody in serum.

(ii) For performing E.S.R.
  (a) it is necessary to collect blood in a fasting state
  (b) it is not necessary to collect blood in a fasting state.

(iii) If the father is blood Group A and the mother is blood Group B
  (a) their baby cannot belong to blood group 'O'
  (b) their baby can belong to blood group 'O'

(iv) If both the parents are Rh (D) positive,
  (a) their baby cannot be Rh (D) negative
  (b) their baby can be Rh (D) negative.

(v) During clotting of blood, Fibrinogen is converted to fibrin by
  (a) prothrombin (b) thrombin

(vi) Anticoagulant activity of EDTA is due to
  (a) chelation of calcium ion
  (b) prevention of thrombin fibrinogen reaction.

(vii) Myelocyte is a
  (a) mature cell (b) an immature cell.

(viii) Myelocyte is
  (a) normally found in the peripheral blood
  (b) not normally found in the peripheral blood.

(ix) Reticulocyte is
  (a) a mature cell (b) an immature cell

(x) Reticulocyte is
  (a) normally found in the peripheral blood
  (b) not normally found in the peripheral blood.

(xi) Major crossmatch for blood transfusion involves agglutination reaction between

(a) receipient's red cells and donor's serum

(b) donor's red cells and receipient's serum

(xii) For the determination of prothrombin tune,

(a) 9 parts of blood is diluted with 1 part of 3.8% sodium citrate solution.

(b) 4 parts of blood is diluted with 1 part of 3.8% sodium citrate solution.

(xiii) For the determination of ESR by the Westergren method,

(a) 9 parts of blood is diluted with 1 part of 3.8% sodium citrate solution.

(b) 4 parts of blood is diluted with 1 part of 3.8% sodium citrate solution.

(xiv) Direct Coombs' (antiglobulin) test measures

(a) 'incomplete' antibody in serum

(b) red cells sensitized by 'incomplete' antibody.

(xv) Anaemia denotes

(a) lack of blood

(b) reduction of red cells

(c) reduction of haemoglobin.

Chemical Pathology

1. What is molar (M) Solution ?
2. What is normal (N) Solution ?
3. What is pH and how it is determined ?
4. What is titration ? Give an example with steps of the method.
5. What are the principles of calorimetry.

6. What are the principles of electrophoresis.

7. Give a short account of the method of paper electrophoresis with an example of its use in chemical pathology.

8. Describe a method for the determination of
   - (i) total protein, albumin and globulin in serum
   - (ii) blood sugar
   - (iii) blood cholesterol
   - (iv) serum bilirubin
   - (v) blood urea and NPN
   - (vi) sugar and chloride in C.S.F.

9. Why haemolysed blood sample is not considered suitable for estimation of blood sugar?

10. Mention the principles involved in the estimation of blood urea. What are the precautions to be taken for the estimation of blood urea.

11. Write notes on
    - (i) 'true' sugar
    - (ii) NPN
    - (iii) Pipette
    - (iv) Burette.

Histology

1. What is fixative. Describe its purpose in histological technique.

2. Name the common fixatives used in the histological laboratory. Enumerate the merits and demerits of formation as a fixative.

3. Discuss the common causes of hardening of tissue in paraffin embedding technique.

4. Mention the differentiating features between elastic tissue and reticulin fibres.

5. Describe the laboratory methods of 'frozen' section.
6. Describe the structure of cell. Draw a diagram and label its various parts.
7. Describe the procedure of haematoxylin and eosin staining.
8. Describe the procedure of reticulin staining.
9. How specimens are preserved and mounted for museum display ?
10. Describe in brief the different parts of a microtome.
11. Describe the manual steps of tissue-processing for preparation of paraffin block.
12. Write short notes on :—
    - (i) Mordant
    - (ii) Hardening of tissue
    - (iii) Dehydrating agents
    - (iv) Clearing agents.
    - (v) Mounting media.

Suggested books for the teachers.

1. A laboratory manual for rural tropical hospitals : Monica Cheesbrough and J. McArthur, Churchill Livingstone, London, 1976.
2. A medical laboratory for developing countries : M. King, Oxford University Press, London, 1976.
3. Concise Haematology : H. J. Woodliff and R. P. Herman, Edward Arnold, London, 1973.
4. Practical Haematology : J. V. Dacie and S. M. Lewis, Churchill Livingstone, London, Fifth Edition, 1975.
5. Parasitology, Protozoology and Helminthology : K. D. Chatterjee, Published by the Author, Calcutta, 1975.
6. Lynch's Medical Laboratory Technology : S. S. Raphael and others, W. B. Saunders, Philadelphia, 2nd Edition, 1976.
7. Clinical Laboratory Methods : J. D. Bauer, P. G. Ackermanu and G. Toro, C. V. Mosby, Saint Louis, Eighth edition, 1974.

TRADE & COMMERCE

—ENTREPRENEURSHIP.

Efficient Class-room organisation is a pre-requisite for effective instruction. All good Class room organisation is an outgrowth of planning. This planning must take into account the following Sectors :—

1. 'Entrepreneurship' in the Vocational Curriculum.
2. Aims of the subject.
3. Materials including the contents of the Syllabus.
4. Activities and Procedures.
5. Evaluation.

1. Entrepreneurship in the Vocational Curriculum.

In all areas of the new +2 years H. S. Vocational Courses, such as Agriculture, Industry (Textile), Technical, Trade and Commerce, and Para-Medical, Entrepreneurship has been made compulsory. It occupies a unique position of its own. It implies that Entrepreneurship as a subject that embodies certain thoughts and principles which are considered vital and basic in all vocations. It is a subject that helps boys and girls acquire knowledge which may provoke immediate entry into a worthwhile economic activity on his own i.e. self-employment. And self-employment occupies a major position in national employment and output.

2. Aims of the subject.

Entrepreneurship is to be taught principally from vocational point of view. Entrepreneurship may also be viewed as an economic-concept.

3. Contents of the Syllabus.

Meaning of Entrepreneurship

Entrepreneurship is the aggregate of activities that are indispensable for initiating a gainful activity. All sorts of money earning activities owe their existence, in the beginning, to some personal traits : ambition, imagination, tact, intelligence, industry, perseverance, self-confidence, will-power, inquisitiveness, power of observation of a person or a group of persons. Such mental traits and attitudes of a promoter or promoters of a venture may be described by the term, 'Entrepreneurship'.

Functions of Entrepreneur

The functions of an Entrepreneur are to be discussed on the basis of the points given below :

(i) Conceiving of some economic venture.

(ii) Formulation of the means of realising the conception.

(iii) Investigating the possibilities with reference to the resources required.

(iv) Assembly of those resources required.

(v) Choosing the form of organisation.

The following matters do not come within the precise jurisdiction of the function of Entrepreneur :

1. Bearing the risks of the venture.
2. Assuming the ownership of the venture.
3. Management and organisation of the venture.

That is, Entrepreneur should not be taught as a fourth factor of production.

Self-employment and Service (or Wage) Employment.

Employment would mean participation of a person in any economically productive work by his physical or mental activity for earning money. Work involves not only on actual work but on effective supervision and direction of work. A person is said to be in self-employment when he is engaged in his own venture to create surplus income called 'Profit'. Their income is called "mixed income" in the latest white paper on National Income Statistics. A person is said to be in service (or wage) employment when he performs services on salary basis. The former is called "working in own establishment" and the latter 'employed by public or private sector establishments'.

Opportunities for Self-Employment : Industry, Trade and Commerce. The object of this unit is to help students to know the scope and opportunities for an independent career in the fields of Industry, Trade & Commerce in the District, West Bengal and India.

Choosing a Business Venture

Several problems basic to all business units are to be analysed and the following aspects are to be considered at the time of choosing and organising a business venture: (1) Survey of the opportunities, (2) Investigation of the resources and facilities, (3) Income earning scope, and (4) Nature of business ownership.

Nature of Business Ownership

It is important to classify business units under the following types as regards business ownership :

(1) Sole trader, (2) Partnership, (3) Co-operative society, and (4) Company.

Each form of business organisation with a particular reference to their legal requirements regarding ownership, method of raising capital, management technique, distribution of profits or surplus, number of owners, registration, liabilities, accounts, dissolution etc. is to be studied. Technical details should be avoided. Experts are available for consultancy and service.

Internal Operations

Efficient and smooth running of any establishment depends largely on the internal organisation of the undertaking. The details of any scheme of organisation must depend largely upon the nature of the undertaking concerned, but certain general principles hold good for every type of business. The general policy of the business should be decided upon at the outset. For example, a manufacturing business should decide first whether it should produce goods of all types of a certain class or specialise in certain types or qualities. A trading concern should decide whether it should concentrate on either the wholesale or the retail side of the business. A Retailer must decide whether its activities are to be concentrated in a single establishment, or whether branches are to be opened.

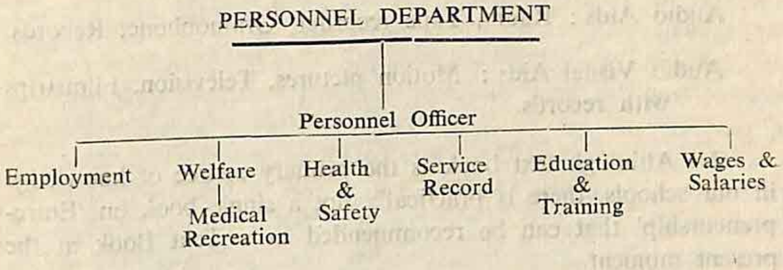
Expansion of Business

Entrepreneurship or enterprise is required not only to establish a new undertaking, but also to expand an existing one. A sound organisation is one which places the enterprise in a position to grow and expand, without dislocation, despite changes in the personnel or methods. Expansion may occur in two ways : the size of the individual undertaking may be enlarged in order to undertake a greater variety of goods of the concern and may establish branches in other localities in order to open up new markets. An ideal organisation if it is stable and secure, must provide for such contingencies.

Employing outsiders

When the business unit expands and grows into a large scale unit, personnel department is introduced. Workers skilled and unskilled, officers and clerical staff are appointed. They are called the employees. Personnel Officer is made responsible to owner or the top management authority of the undertaking for the activities of the workers.

The chart given below may give an idea of his function. The undertaking becomes a Team gradually.



GOVERNMENTAL AND OTHER ASSISTANCE FOR SELF-EMPLOYMENT PROMOTION.

Under the impetus of a planned economy both Central and State Governments, as well as Private institutions are gathering information and preparing schemes for establishment of small and medium industries. There are arrangements for encouraging and promoting self-employment. There are schemes for providing guiding services and also financial help. Government have also established training centres for various industries. Block Development Office, Local branch of banks, factories and other business houses are to be contacted for securing information on self-employment promotion oppotrunities available in the locality.

Materials

Materials that may be used for instructional purposes may be divided under three heads :—

1. Audio-Visual Aids.
2. Text Books.
3. Supplementary Materials.

Points for Consideration and Discussion.

1. Usefulness of each of the following aids in the teaching of Entrepreneurship.

Visual Aids : Black Board, Chart, Diagrams, Pictures, Samples, Models, Specimens, Business Forms, Filmstrips, Slides, etc.

Audio Aids : Radio, Tape recorder, Gramophone, Records.

Audio Visual Aids : Motion pictures, Television, Filmstrips with records.

2. Although text book is the primary source of knowledge in our schools, there is practically not a single book on 'Entrepreneurship' that can be recommended as a Text Book at the present moment.

3. We know that there are certain materials that can serve the purpose of a text-book. Those materials are of so importance that even the availability of a text-book should not defer us from using those materials. There are limitations of the text book. We should use other materials to supplement it. These supplementary materials should be relevant, appropriate to the unit as well as in experience and easily available.

How to get Instructional materials ?

(i) To get from outside : The teacher can get different types of materials from outside i.e. business houses, bank, post office, newspaper, bookseller, Library, State and Central Government etc.

(ii) To prepare inside : The teacher may prepare some instructional materials. Charts, diagrams, pictures, text books etc. can be prepared by the teachers.

4. Activities and Procedures

The following are some of the methods that can be used in teaching 'Entrepreneurship'. The list is not complete, nor are the methods mutually exclusive. Different combinations may prove effective in different units of studies in Entrepreneurship.

Lecture Method, Question and Answer Method, Discussion Method, Committee Method (Group Dynamics), Dramatisation Method, Project Method (case study).

We should also consider appropriate activities for involving students. The nature and extent of students' participation will vary largely depending upon the availability of material and other resources. For example, a person who has had relevant occupational experience, if there is one in the locality, can be invited to explain some of the details to the class. There is a great scope for the use of community resources in teaching 'Entrepreneurship'. The findings of the Seminar should cover also how far (i) organising field trips, (ii) inviting guest speakers, and (iii) conducting surveys in the community, would be utilised for imparting knowledge and understanding or entrepreneurship.

5. Evaluation

Effective teaching demands systematic evaluation which must be related to the objectives of the courses. Students should be given a clear idea of what is going to be evaluated.

TRADE AND COMMERCE

(Vocational)

Paper II (Marks 50)

Basic Theory

There lies an economic basis in Trade and Commerce. Commerce is sometimes called 'Business Economics'. The subject is concerned with man's behaviour in the pursuits of wealth. In Economics, wealth consists of those goods and services which have three basic characteristics namely, utility, scarcity and transferability. A commodity that satisfies all these conditions has value and is viewed as 'wealth' in Economics. And such commodities which command prices are of major concern in Trade and Commerce. So the various items of studies included in the syllabus under the heading **'Economics'** are to be taught from the point of view of Business Economics.

Every Economic work is done through organisation, rather than by people working as individuals. In doing its work, an organisation uses resources—material, labour and various types of services. In order to work efficiently, the people in an organisation need information about these resources and about the outcomes of the venture. Even parties outside the organisation need similar information in order to make judgments about the organisation. The system that provides this information is called **Book-keeping and accounting.** The various aspects needed to be achieved in teaching this unit of the Basic Theory have been discussed, in details, in "Teaching Guidelines on 'Accountancy' (Elective Papers III & IV).

Business activities entail a considerable amount of communication both among members of the organisation as well as with outsiders. The office is that part of the organisation which helps the planning, control and co-ordination of business operations through communication and records. Keeping these points in mind, the various units of studies under the heading "**Office Practice**" are to be taught. Details of the teaching techniques for this unit have been discussed in the Teaching guidelines on "Office Procedure and Routine" (Elective Paper III & IV).

Maintenance of a Museum-cum-Commerce Laboratory

All institutions, imparting education in Trade and Commerce (vocational) should maintain a Museum-cum-Commerce Laboratory where students will get an opportunity to explore the functional aspects of the world of Commerce that they obviously could not experience. A Common list of items for such Museum-cum-Commerce Laboratory is given below :—

Equipments

1. Addressing Machines (Addressograph or Roneo)
2. Franking Machine.
3. Automatic Dating, Numbering and Price Marking Machines.

4. Gumming, Sealing, Stamp Affixing, Folding, Stapling, Punching Machines.
5. Files : Old and modern.
6. Filing Cabinets.
7. Comptometer for Calculating, Addition, Checking invoices etc.
8. Copyholders.
9. Stop Watch, Tape Recorder.
10. Typewriter, Duplicating Machine (Small)

II Documents & Directories

1. Specimen of Common Commercial Documents used in Trading, Banks, Export and Import Business, Customs, Railways.
2. Charts, Diagrams, Maps (West Bengal and District Maps) for class use.
3. Specimen Account Books, Minute Books etc., Cash Book, Purchase Book, Sales Book, Journal, Ledger, Trial Balance, Final Accounts.
4. Postal Guide, Railway Goods classification, Telephone Directory, General Year Book, Ready Reckoner.

III Folding Black Boards, and Ruled Graph Boards.

N. B. This is a common list of exhibits for all Museum-Cum-Commerce Laboratories. For each of the Specific Pair of Courses, some additional documents and appliances will be necessary. It is well worth the effort to investigate the possibility of securing some documents and appliances on loan for a specific period of time from the state government or local museum.

Student's activities in the said museum-cum-Commerce Laboratory is to be organised in conjuction with some type of learning experience being provided in the class room.

TRADE AND COMMERCE

(Vocational)

Office Procedure and Routine

Paper III Theory (Marks 100) & Paper IV Practical (Marks 100)

It is widely believed that office procedure and Routine is a very practical subject and that the subject is worth while for vocational point of view. For all students of Trade and Commerce, there is a Basic Theory Paper of 50 marks in which a portion of 'Office Practice' is made a part. It justifies the importance of knowledge and understanding about office procedure and routine that a student needs if he intends to join any vocation in any areas of Trade and Commerce. So the emphasis in teaching this subject should be more on building skills, although promoting understandings and developing the capacity to think independently should be involved. The importance of right attitudes towards office work should be stressed. The approach and selection of method of teaching will therefore have to be evolved out from this point of view.

The topical approach seems to be more appropriate for teaching this subject. An effort should be made to introduce the students to the vocational implications of the units studied. Illustrations should be drawn from the immediate world of work. Because of its skill development contribution, the teaching of office procedure and practice should satisfy the vocational aspiration of students. A proper understanding of the principles and practice of office organisation together with accompanied skills may help students become useful workers in business houses and industrial offices. The teaching of the subject is to be so designed as to help students to appreciate the purpose of an office which is to be defined as "the providing of a service of communication and record."

All the units of studies set out in the syllabus are, in fact, elaboration of the basic functions of an office, viz.,

1) Receiving Information,
2) Recording Information,

3) Arranging Information,

4) Giving Information,

5) Safeguarding Assets.

Such functions must be performed in any business unit. In the case of a very small business unit, the proprietor himself does everything. Office does not exist in a separate form. But a big business house will always need an office as an aid to the management of the business.

The principal types of learning outcomes in this subject may be characterised as understanding, appreciations and skills. Understandings and appreciations may result from acquisition of knowledge of a body of facts presented in a well co-ordinated manner. The development of skills would require the individual to experience repetitive practice on drill on some process directed towards a recognised goal of achievement.

The use of visual aids should be made a 'must programme' in teaching this subject. Well illustrated books can be utilised as reference-books for the relevant units of the syllabus. Students learn well to do by doing. Some ample opportunities are to be provided in the office or in the Museum-cum Commerce Laboratory of the institution in which they are reading. They do also learn well by getting first-hand experience. Field trips may provide an opportunity for a first-hand learning experience to the students. They help in developing a deeper insight into the operation of an office.

Work book on Practical Operations

The use of work book is recommended because their proper use will make learning effective. They are to be prepared in the style of Laboratory Note Book. The learning experience of a student through actual operation (by doing) or first hand experience (by field trips) are to be described in the work book. The Work-book should contain charts, drawing or other illustrations that are not usually available in a text book. Students are to acquire adequate knowledge about the operation and handling of the following :

(1) Equipments for general office services.
   - (a) Typewriting
   - (b) Filing and Indexing.
   - (c) Duplicating and Reproducing
   - (d) Communicating (mail, Telephones, etc.)

(2) Accounting Machines :—
   - (a) Adding Machines
   - (b) Posting Machines
   - (c) Punched Card Machines
   - (d) Calculating machines

Students need to collect all types of forms that are needed for utilising postal services, in particular, for rapid communication.

Special Notes on Topic Items

1. **Modern Commercial Office :** The start should be broader to explain how office is universal in every kind of organised institution from schools and colleges to government. The item should be exemplified without pinning down the item heading. Note that the points covered are in general terms. **Exercise** on drawing simple and neat office layout may be enough. Office mechanisation with examples of the most common Office machines and equipment must be brought in.

2. *Filing* : Too many details and all varieties of sophisticated filing and indexing need not be given.

Exercise on actual **Filing** in some local establishments may be tried indicating possible improvements. Exercise may also be given on Indexing of correspondence as may be found in practice. Students may be asked to index and file through Practice Classes.

3. **Office Records :** Handling of Incoming and Outgoing Mails with details should be focussed, from pinning to flow of

papers within the Office. **Organisation Chart** may be shown in broad terms only to help understanding **without** going into their preparation.

4. **Correspondence** : Drills in drafting should be more for the Practical Paper. Theoretical guidelines for drafting of the specified types of letters should be given in details for the Theoretical Paper. Students are to be acquainted with sizes of Papers, Letterheads, Envelopes etc.

Proof Reading is the new item and should be dealt with.

5. **Postal Information :** Postal Manuals should be used. Postal Services and Rules etc. may be for Theoretical Paper. **Exercises** on **methods** of using postal services should be assigned for Practical Paper.

6. **Telephones :** Telephone Directories and other publications should be used in details.

Duties of a Telephone Operator should be introduced. In many Offices an Assistant may be assigned such duties along with some other office work.

7. **Evaluation of Clerical Work and Efficiency :** Here concepts of merit rating and office work costing and efficiency may be introduced without very high techniques.

Practical Paper : The topics where repeated exercises and drills are suggested under the Syllabus heads may be the items for the Practical Paper. It may be better to discuss the specific items for Practical work. Practical Paper may be on following items :

(a) Inward and Outward Mail Registers ; (b) Postage Book; (c) Indexing of Correspondence; (d) Drafting of prescribed types of letters; (e) Drafting of Telegrams; (f) Exercise on Clerical Work Measurement; (g) Abbreviations.

Beside each student should maintain a work-book on Practical operations.

Some Readings for Teachers

1. Office Organisation and Management : S. K. Sahni and G. S. Sundaresh (Oxford & IBH Publishing Co.)

2. Office Management : J. C. Denyer (Mcdonald Evans Ltd.)
3. Office Organisation and Management : Donal Cousins. (Pitman)
4. Office Practice : William Campbell (Pitman)
5. Management Information Systems (Reporting by Enterprises to Govt.) : Bureau of Public Enterprises, New Delhi.

TRADE AND COMMERCE

(Vocational)

Co-operative Organisation and Operations

Paper III Theory (Marks-100) & Paper IV Practical (Marks 100)

Co-operative organisation and operations should be taught from the point of view of the individual, his personal employment and consumer needs. This can be achieved even if the subject satisfies the vocational aspiration of students. Co-operation is believed to be the panacea of all economic evils in Indian economy. The Government is trying to popularise the system. The employment opportunities in this field is sure to increase. Keeping this aspect in view, teachers should aim at achieving the following instructional purposes or objectives.

1. To help students know basic laws and principles of co-operative organisation.
2. To develop in students skills of some of the routine work of a co-operative organisation.
3. To enable students to appreciate co-operative organisation as a business organisation.

As the text-book material is inadequate and as other reading materials are so widely scattered that it is often difficult to direct student to them, the lecture method seems to be the best method in teaching the theoretical paper of the subject. But every attempt is to be made to supplement it by discussion and practice. The lecture interpolated with discussion, questioning and answering, chalkboard explanation and filmstrips presentation would be very useful in motivating students to learn the subject effectively. A rich source of instructional material for the teacher of this subject is the community in which the school is situated. If the school fails to run a co-operative store, a near-by co-operative organisation should be visited with definite objects of securing supplementary materials for the class work. Case stories is one of the fascinating ways to introduce the practical aspects of running a co-operative. The teacher should have some practical experience which he can relate. For the sake of variety, the teacher may also invite outsiders to speak to the class. Role playing is a form of activity that also has some learning value. For example, when the students learn all the basic elements of a co-operative organisation, students may act out the roles of people in a co-operative society. Dramatisation is a very helpful aid which can be used occasionally.

The following practical studies and operations are suggested:

1. Acquaintance with various types of legal Forms and West Bengal Co-operative Societies Act.
2. Issuing Notice for convening Managing Committee's Meeting, Annual General Meeting, Special General Meeting—Procedure of conducting them—drafting proceedings of the meetings.
3. Maintenance of Accounts (viz. share capital).
4. Visit to a Co-operative Society.

TRADE AND COMMERCE

(Vocational)

BANKING

Paper III : Theory (Marks 100)

Guidelines on the different units of studies of the syllabus

Banking is a complicated business, because it is not just one business, but a combination of many, say, from counting of cash to knowing intimately the working of a modern factory. In fact, the word "Bank" is so complicated that a satisfactory and comprehensive definition of the word does not appear in the laws that govern banking.

Working in a bank is quite interesting, although many people think that it is a dull business. This is possible because bankers, by nature, are cautious and talk little about their profession. A loose talker is always a misfit in a bank.

There is a combination of factors in banking which attract students to this profession. Some of these are :—

(1) Banking consists of many activities which appeal to individuals of different interests.

(2) Banking is a growing business that expands with the development of economy, and as such, Banks require a high proportion of officers.

(3) Banking offers opportunities for rapid advancement of position of high responsibilities.

(4) People who work in a Bank find opportunity of making friendship with diverse section of people.

(5) Banking compares favourably with other business on such things as, competitive salaries, steady pay rises, desirable working conditions, internal training programme, security of service and social status.

Banking is a challenging, exciting and rewarding activity. It is meant for those who are practical—who understand and appreciate the use of money and creation of surplus and utility in society, with the change in the outlook of banking there is a growing demand from banks for men who are capable of independent, original and critical thought. Education and learning are great assets but they can never replace necessary training and experience. Highly educated persons are good basic materials to be turned into efficient Bank officers. A person of average ability can also become a very good banker. What the banks need are men of strong common sense and zeal and those who are capable of hard and intelligent work. Accuracy is also a very necessary quality in banking, without which one would work endlessly for a futile purpose. Finally, to be a successful banker one must be able to create good impressions by his manners, appearance, speech etc. Besides he should be mentally alert to understand and analyse and grasp essential points.

In the field of practical banking, special provisions and for formalities relating to different types of accounts as given below that are usually opened by commercial banks, are to be rigidly followed : Detailed instructions regarding such special provisions and formalities to be observed are generally contained in Bank circulars to branches, Manuals etc. issued for guidance of the employees.

(1) Individuals

(2) Hindu Undivided Family

(3) Joint Accounts (Either or Survivor, Any one or Survivor)

(4) Sole Proprietory Firms

(5) Partnership

(6) Limited Companies—Public and Private

(7) Co-operative Societies/Banks.

(8) Clubs, Associations, Charitable Institutions, Friendly Societies etc.

(9) Trust-Executors, Administrators, Liquidators etc.

(10) Non-operating collection Accounts.

In opening a Current Account of any of the above types a Bank has to be very particular about introduction of the prospective customer. Without a proper and satisfactory introduction a person (a individual, firm or company) opening an account with a bank cannot be treated to have accquired the status of its being a customer, in accordance with banking laws and custom, so as to entitle the bank to claim successfully the statutory protection in the matter of collection of cheques and other negotiable instruments. A Bank, opening current accounts, therefore, incurs definite obligations, and in case it is proved that a bank was negligent when opening a current account it might not get the protection under Section 131 of the N. I. Act which protects banks when collecting crossed cheques in good faith and without negligence. From this point it is essential that all persons, firms, companies etc. for whom current accounts are opened must be properly introduced before accounts are opened in their names.

As for opening current accounts of (a) sole proprietory firms and (b) (unregistered) partnership firms banks have to be particularly careful. In view of the fact that registration of firms is not compulsory under Indian law, very few firms of the above two types get themselves registered. Banks, therefore, in opening accounts of such firms are not able, on a reference to records of the Resistrar of Firms which would have been possible otherwise to authenticate or get a fool proof verification of the constitutions of the firms and of the declarations of the persons claiming themselves to be sole proprietors or partners of the firms.

As a result, Bank officers, in recording the constitution of such firms in their books have to a large measure depend upon the declarations of the persons concerned. The risks that may be involved in opening accounts of firms in this manner and in handling their collection business cannot be overstated.

If, however, a firm is registered under the Indian Partnership Act, a certified copy of the certificate of Registration issued by the Registrar of firms should be called for to be retained with the Bank.

In the case of a borrowing account of a partnership firm, the Account Opening Forms and the Loan Documents must be signed by all partners of the firm except in those cases where the partnership deed of the firm is registered with the Bank and authorises one or more of the partners to sign and execute documents for borrowing on behalf of the firm, in which case they can be signed by the partners authorised to do so. Even in such cases it is preferable for Account Opening Forms and Loan Documents to be executed by all the partners.

Notice from a partner to stop payment of a cheque drawn on the firm's accounts even though not drawn by him but by one or more of the other partners (having authority and power to operate the account) should be acted upon as it is to be considered a notice of withdrawal by the partner of the authority vested by him in others to operate the account.

Another very important thing to be borne in mind by bank employees that cheques in favour of a firm should not be credited to a partner's personal account without the written confirmation of all the partners for if it is done the Bank is liable to be held for conversion of the money involved.

Circumstances and contingencies under which a partnership firm may be dissolved by the consent of all the partners or in accordance with the contract between the partners or by the operation of law are detailed in Section 39 to 44 of the Indian Partnership Act.

In opening of Current Accounts in the name of Joint Stock Companies, it must be ensured by the Bank that the directors of the Company are well-known and respectable people and the Chairman or one or more directors of the company are personally known to responsible officer of the Bank. Instances have occurred where unscrupulous persons have succeeded in opening accounts in the names of limited companies with spurious copies of Memorandum and Articles of Association and Certificates of Incorporation/Commencement of Business etc. and encashing cheques through such accounts drawn in favour of a payable to a real company with identical or very similar names.

The signatures of the Chairman of the Company on the certified copy of the resolution of its Board of Directors authorising the Bank to open the account on the Account Opening Form or other documents executed for or on behalf of the Company, or appearing on other documents sent for examination or filing with the bank, should as far as possible, be known to the Bank and in any case, must be verified to the satisfaction of the Manager or a senior officer before opening the account of or having any dealings with the Company.

In extending borrowing facilities by way of Loans, Cash Credits etc. the Bank must bear in mind a few salient points, such as :

(a) Under restrictions imposed by the Companies Act 1956 the Board of Directors of a Company cannot borrow without the consent of the Company given in a general meeting in excess of the aggregate of its paid-up capital and free reserves.

(b) the power to borrow moneys (otherwise than on debenture) can only be exercised under authority of resolutions passed at meetings of the Board and not by circulators.

(c) That the power to borrow may be exercised by the Board of Directors on behalf of the Company either by themselves or they may exercise the power to borrow moneys (otherwise than on debenture) by delegation.

A Bank employee must be thoroughly conversant with the routine formalities to be observed in payment of customers' cheques all of which cannot be enumerated in short space. Verification of proper signatures on cheques and other mandates is however of utmost importance in view of bank's legal obligation to know customers' signature. Endorsements of order cheques are to be scrutinised before payment is effected and cheques with irregular endorsments should not be paid. A bank employee must know, when payments can be refused in other cases also. Printed forms enlisting bankers usual objections to unpaid cheques are available in banks. A paying banker can claim the legal protection afforded to him only when he pays a cheque drawn on him in due course. (Payment in Due Course—Section 10 of the N.I.Act 1881).

A customer has a right to stop Payment of a cheque issued by him before its payment by the Bank when a customer advices the loss of a cheque book/leaf, such loss is to be properly recorded in the "Stop Cheque" register and further actions as per Banks instructions given in the Manual or Circulars must be promptly taken.

There appears to be a misapprehension among some people about cheques crossed "Account Payee only" and this probably requires some clarification.

Neither the transferability or the negotiability of a cheque is limited by the addition of the words "Account Payee" or Account Payee only". Such words cannot affect the drawers' mandate to the drawee and the paying banker fully discharges his duty when he pays in accordance with the crossing apart from the addition, not provided for in the N.I.Act. Even if the cheque bears evidence of endorsement, the paying banker would appear to be protected although he ignores the addition, but, as the words are intended for the guidance of collecting bankers, it is desirable that they do not collect crossed cheques marked "Account Payee only" for any account other than that of the original payee ; otherwise they are likely to loose the benefit of Section 131 of the N.I- Act.

Banking

Paper IV (Marks 100)

Deposit Accounts

1) Savings Bank Account
2) Fixed and Time Deposit
3) Recurring Deposit
4) Fixed Deposit linked with Recurring Deposit
5) Housing Recurring Deposit
6) Deposit Certificate.

Savings Bank Deposit is the commonest form of deposit. A Savings Bank account can be opened by an individual, an illiterate person, a natural guardian on behalf of a minor, a minor above the age of 10 years singly in his/her name and by non-profit making institutions like clubs, association, educational institutions etc. In case of individuals accounts can be opened either singly or jointly with others. Where the deposit account is opened in joint names the amount can be made payable to (1) jointly to all depositors or (2) either or survivor or survivors, or (3) former of survivor.

Fixed Time deposits may be accepted from Firms and Companies, Individuals, Trusts, Charitable and Educational Institutions, Public Bodies etc. Interest rates payable on all deposits are governed by the directives issued by Reserve Bank of India from time to time.

A Recurring Deposit Account can also be opened in the names of Individuals (either in single or joint names), Clubs, Associations, Trusts, Firms and Companies etc. There is usually no restriction on the maximum monthly deposit but it is generally in multiples of Rs. 5/-. Recurring Deposits are usually made for 12/24/36/48/60/72/84 months. Maturity yields on Recurring Deposit Accounts for various terms, as above, are based on applicable rates of interest for such terms and can be ascertained from banks. A monthly deposit of Rs. 5/- would yield Rs. 62.75, Rs. 130.75 and Rs. 610.00 at the end of 12, 24, and 84 months respectively.

Interest on Fixed Deposits can be paid by Banks to the depositor every month at his written request. If this interest is invested by the depositor in a Recurring Deposit Account the depositor would get additional benefit.

Housing Recurring Deposit Scheme has been evolved with the idea of providing an opporunity to members of the middle class who are in regular employment or have a regular professional income to own houses of their own. Under this scheme an individul has to plan in advance for purchase or construction of a house at a later date and start saving.

Under Deposit Certificate scheme a depositor has to deposit a fixed amount for a fixed period. The principal and the accrued interest amount are paid to him on maturity. In case of Deposit Certificates of 61 months, 7 years, 10 years, 15 years and 21 years deposits in denomination of Rs. 1,00/-,= the amounts of yields on maturities are Rs. 1,665/-, Rs. 2,010/- Rs. 2, 712/-, Rs. 4,465/- and Rs. 8, 123/- respectively.

Current Accounts Opening Forms

(a) Individual Account.

(b) Joint account (operation by "either", "any two or more", "all" etc.)

(c) Sole proprietory Accounts—Declaration of sole proprietorship of the Firm.

(d) Societies, Clubs or similar bodies—Authority to operate on the account to be given by the Chairman and the Secretary.

(e) Partnership Firms—Registered/Not Regsitered with the Registrar of Firms—may be written or verbal—a declaration confirming that terms of partnership arrangement do not in any way conflict with the provisions of the partnership deed and that there are no restrictions on the powers of any of the partners to open and operate banking account.

(f) Joint Stock Companies—(i) Certificate of incorporation (ii) Certified copy of Memorandum and Articles of Association with latest amendments if any (iii) Certificate of commencement of business, (iv) Certified copy of Resolution of the Board of Directors regulating conduct of the Account (specimen of resolution usually given on Account Opening Form).

Note : (i) and (iii) are generally for inspection and return.

Specimen signatures of authorised operators of all the above types of accounts are taken on separate specimen signature cards.

II Paying-in-slips for Cash and Cheques—Ledgers (bound book or loose leaf)—posting of ledger—writing of Pass Book/Statement of Accounts—Preparation of Vouchers—debit and credit vouchers with advices.

III Issue of Cheque Book—Printed Cheque forms—"Bearer" and "Order" cheques (specimen of cheque leaf)—writing of cheques—Crossing of cheques—general and special crossings and their significances—"Account Payee" Crossing and "Not Negotiable" Crossing—Payment of cheques—Open (Cash) Cheques, Clearing cheques, Transfer cheques—scrutiny of cheques before payment—Mutilated cheques—postdated cheques—Stale cheques—specimen forms of endorsements of Order cheques—spelling (Correct and Incorrect)—married and unmarried women—joint payees—

Illiterate persons—Firms—Limited Companies—clubs and associations etc. etc. objection memo to unpaid cheques.

IV Collection of out-station cheques—Remittances—Demand Drafts—Mail Transfers, Telegraphic and/or telephonic transfers, telex etc.

V Loans, Advances, Cash Credits, Overdrafts, General principles of lendings—Advances to small scale industries—Appraisal as to (a) Constitution of the borrower, (b) whether already established or a new entrepreneur, (c) whether he requires bank accommodation for supplementing his own finance, (d) Nature of the project/business, (e) financial feasibility (cost of project, capital, reserves long-term borrowing if any etc.) (f) technical feasibility (land and building, plant and machinery, raw materials, power, water, technical skill etc.), (g) Appraisal of Borrower—(Integrity, technical skill, experience, market reputation, entrepreneural, skill, past performances etc.)

VI. Common Decuments executed for advances against pledge or hypothecation merchandise commodities, agricultural produce etc :

(i) **Demand Promissory Note**

(a) in case of an individual

(b) joint or several—partnership firm

(D. P. Note is not taken in case of Term Loans)

(ii) Deed of Pledge or Deed of Hypothecation

(iii) Letter of continuity

(iv) Letter of waiver for the waivement of insurance covering risks of burgalary, theft etc. (where necessary)

(v) Letter from land-lord in case of rented godowns for allowing free and uninterrupted access at all reasonable times in case of godowns having indirect access.

(vi) Insurance Policy for full value of goods in the name of Bank A/c Borrower; or Bank as mortgagee and borrower as mortgagor specifying type of godown, the actual place of storage and general description of goods with agreed Bank clause attached thereto against fire risks, S. R. C. C. (Strike, Riot, Civil commotion) risks to be covered wherever necessary.

Note : 1) Re: **Deed of Hypothecation**—In case of joint stock company charge is to be registered with the Registrar of Joint Stock Companies within 30 days of execution of documents. (Deed of Hypothecation should be accompanied by a copy of D. P. Note and unstamped copy of Hypothecation Deed).

2) In case of advance against shares Letter of Lien should be executed by the Borrower (S).

VII **Agricultural Finance**—Crop Loan Scheme—the need for the scheme—the objectives of the scheme —eligibility—scale of finance—cropping pattern —time of disbursement—procedures to be followed in making agricultural advances :

(a) Identification

(b) Personal interview

(c) examination of revenue records—enquiries with regard to encumbrances on property whether the farmer can mortgage land as security particularly when the loan is more than Rs. 3000/- or so.

TRADE AND COMMERCE

(Vocational) Insurance

Paper III : Theory (Marks 100)

and

Paper IV : Practical (Marks 100

Guidelines on different units of studies of the syllabus

Insurance is a device by which a big probable loss is matched by a sure small loss. As a business it is carried on in four main classes ; life, fire, marine, and accident or miscellaneous. The last three classes together are also termed General Insurance. All these four classes of insurance business as well as general insurance business have been defined in section II of the Insurance Act 1938.

Like all other business insurance is also transacted by entering into contracts. Contracts are legally binding agreements. But there is a special difference between ordinary commercial contract and insurance contract. In ordinary contract both parties to the contract must observe normal good faith. But in insurance contract both parties are under legal obligation to observe utmost good faith. The duty of utmost good faith implies that a proposer must disclose to the insurer all material facts in regard to the proposed insurance. A material fact is a fact which would influence the judgment of a prudent insurer in deciding whether to accept proposal for insurance and if so at what rate of premium, and subject to what terms and conditions.

Another important difference between an ordinary commercial contract and insurance contract is the presence of insurable interest. Insurable interest is required to support the contract of insurance in order to make it enforceable at law. In the absence of insurable interest, no contract insurance can come into existence. A contract of insurance does not undertake to prevent the occurrence of the event insured against. What it provides is a promise to make good the financial loss caused by the occurrence of the insured event. Any person in India cannot take out a life insurance policy on the life of Queen of

England because he is not likely to suffer any financial loss in the death of the Queen. Similarly a person cannot insure the motor vehicle which does not belong to him or he has no connection with the motor vehicle to make him suffer financially in case the motor vehicle is lost or destroyed. So what is insured under a policy of motor insurance is not the motor vehicle, but the insured's financial interest in that vehicle. It would therefore be clear that insurable interest is a legal right to insure and it arises out of the insured's pecuniary interest in the property or the life.

There is a difference between life insurance contract and general insurance contract. A life insurance contract is a contract to pay. But a general insurance contract is a contract to indemnify that is, to put the insured in the same financial position after the loss as he was before the loss. In a life insurance policy of, say Rs. 10000/-, the entire amount will be paid when claim occurs. But in a motor car insurance policy of Rs. 10000/-, the policy amount does not necessarily become payable if the motor car is destroyed in an accident. The insured will get only the market value of the car ; if the car was valued only Rs. 8000/- on the day of the loss, the insured will get only Rs. 8000- and not Rs. 10000/- even though he has insured car for Rs. 10000-. This difference in the settlement of the claim in a life insurance policy and a motor car insurance policy is due to the fact that the latter policy is governed by the principle of indemnity. Other principles which differenciate general insurance policy from life insurance policy are subrogation, contribution and proximate cause. Subrogation may be defined as the transfer of rights and remedies of the insured to the insurer who has indemnified the insured in respect of the loss. Contribution is a right of an insurer who has paid a loss under a policy to recover a proportionate amount from other insurers who are liable for the same loss. The principle of proximate cause is based on that of cause and effect which states that having proved the effect and traced the cause, it is not necessary to go further. In other words the principle makes it unnecessary to trace the cause of causes.

There is also difference in claim settlement under a life policy and a general insurance policy. In a life insurance policy, evidence of death of the insured person is sufficient for establishing a valid claim. But in a general insurance policy establishment of the loss is not sufficient for a valid claim. The cause and circumstances of the loss have also to be established unlike other classes of business, insurance business has been very closely controlled by Government because of its great importance to the well being of society. If the insurance business is carried on unwisely, there is a risk of great harm to the interest of policy holders. In an ordinary business unwisdom on the part of the management is likely to harm the interest of share holders only. But not so in the case of insurance business. Because of this reason, insurance business in India is transacted by two Government of India undertakings ; viz. Life Insurance Corporation of India and General Insurance Corporation of India. LIC transacts life insurance business and General Insurance Corporation with its four subsidiaries transacts general insurance business that is, fire, marine and miscellaneous.

The course in insurance is so designed that after completing it successfully, the student may find suitable job in LIC or GIC or he may start independent work as an avisor in respect of general insurance or life insurance or as a loss surveyor or as an insurance agent without the need of further training.

For this purpose syllabus envisages practical training in the school and outside in LIC or GIC or both. Training in LIC/GIC is necessary for imparting the students applied side of their study in an organised office. It will help them to have a fair idea about the operational system and behaviour of an office and will enable them to face a job situation with confidence.

For the purpose of getting full advantage of the practical training it is necessary that a student should not only know the theoretical principles of insurance of all classes but he should also be taught about the machanism of insurance and be familiarised with the procedural aspects of office work with regard to acceptance of proposals, documentation and settlement of claims. Various printed forms are used in the offices of LIC and GIC to document the various stages of acceptance of proposals, issue of policies, amending the policies and settlement of claims. It is necessary that students should become familiar with these forms and should also know how to complete them and scrutinise them.

As has been mentioned earlier, insurance business in India is very much controlled by law. There are a number of Acts which deal with insurance business. Iusurance Act 1938, Life Insurance Corporation Act 1956, General Insurance Business (Nationalisation) Act 1972, Motor Vehicles Act 1939, Workmen's Compensation Act 1948, Marine Insurance Act 1963, Employee's State Insurance Act 1948, and Indian Stamp Act 1899. Perhaps relevant provisions of these Acts may not be available at present in one book. The subject teacher has to make his own complete notes to help students in this regard.

TRADE AND COMMERCE (Vocational)

COST ACCOUNTING

Paper III Theory (Marks 100) & Paper IV Practical (Marks 100) Special Notes on Topic Units.

1. Definition of 'cost', 'costing' and 'Cost Accounting'. Why Cost Accounting? Concept of a Cost Unit. Cost units for tangible products and intangible services. Concept of 'Cost Centres' for control.

2. Different types of classification of costs to be introduced. With the help of simple illustration, distinction between Direct and Indirect cost to be explained.

3. Preparation of Cost Sheet to be shown. From total cost of a batch, cost per unit to be ascertained at each stage (Prime Cost per unit, Factory Cost per unit etc.)

4. Distinction between direct and indirect materials. Circumstances under which direct material of small value is treated as indirect materials. 'Value of receipts' of materials should include inward carriage paid. Simple methods of pricing materials issued (F.I.F.O., L.I.F.O. and Simple Average Price) to be taught. The impact of different methods of

pricing on stock valuation to be noted. Treatment of primary packing material and secondary packing material to be taught.

5. Time recording for arrival and departure of workers as well as recording job time (time spent by directed labourers on jobs) to be discussed. Concept of idle time emerges here. Reasons for and classification of idle Time may be given. Time rate and Piece rate method of paying wages. Overtime payment for work beyond normal hours. Ill effects of overtime. Analysis of wage cost. Direct wages for jobs, indirect going to overhead.

6. Functional classification of overhead. Items coming under Production overhead. Collection of figures. Allocation to Deptts. Bases of apportionment (floor space, no. of workers, light points etc) The rates commonly used for recovery.

For Office and Selling & Distribution overhead, methods of recovery need not be shown. Items coming under them may be explained.

Trade and Commerce (Vocational)
Accountancy

Paper III Theory (Marks 100) & paper IV Practical (Marks 100)

Amongst the subjects to be studied in 'Trade and Commerce' Vocational Stream, Book-keeping and Accounting is perhaps the most significant subject for studies. For all students of Trade and Commerce there is a Basic Theory Paper of 50 marks in which a portion of Book-keeping is made a part. In this unit of study, teachers would do well if they can help students grasp very clearly the various basic steps involved in the complete Book-keeping Process as early as possible through working out simple problem consisting of ordinary transactions with which the students are acquainted.

The basic steps in a complete Book-keeping Process are :

(1) Identification of Transactions

(2) Recording transactions in Journal from vouchers.

(3) Posting to the Ledger.

(4) Balancing of Accounts and preparing a Trial Balance

(5) Preparing Final Accounts.

Students need to acquire a basic knowledge about the relationship of each of the Book-keeing steps to the previous as well as to the subsequent step. The understanding of this relationship is to be considered essential. Students are to be made familiar with the above-mentioned basic steps in Book-keeping in its very simple form, as quickly as possible. The elaboration of one or the other steps in Book-keeping cycle is to be made, in complete details, while teaching 'Accountancy' as an elective subject in 'Trade and Commerce' Vocational Stream Courses. Although this subject (i.e. Accountancy) is meant to be practical and the record-keeping aspect of the subject is to be emphasised, the understanding and analytical part of the processes should not be neglected. Practical training without providing a theoretical background loses much of the joy of practice. Before teaching a student how to do a certain thing, he should be given to understand what he is being asked to do and why it should be done in a particular way. Unless this is done, not only he may find his work uninteresting, but in all likelihood, he will be made what may be termed as "an unintelligent worker" who will not be capable of making suitable adjustments in differing circumstances. Proper blending of theory and practice is demanded in teaching this 'Accountancy'. It is true that if the analytical aspect of Accounting is adequately attended to and is introduced, the teaching would become more meaningful, effective and satisfying to the students, and the students' achievements would then be more impressive and worthwhile. That means, although the subject is to be vocation based, it is to be taught so as to develop and sharpen logical thinking, right attitudes towards work, and desirable personality traits. More precisely teachers are to endeavour to make the students learn and understand principles and conventions of accounting evolved over a period of time and to develop in them the desired skills of preparing simple financial statements, records, reports from given details and to develop an ability to analyse and interpret such statements and reports. The practical aspect of the subject should demand the following development in students.

(1) Skill of drawing proper form of journal, Day Books, accounts and financial statements and so forth.

(2) Skill of legible writing and neat and clear presentation of figure work.

(3) Skill of filing vouchers and all other relevant business papers.

(4) Skill of recording transactions in Day Books and Journal from a given set of vouchers and other documents.

(5) Ability to find out the points of difference between the Pass Book and Cash Book on a particular date and to make a reconciliation of the balances of these two books on a particular date.

(6) Skill of determining gross profit and net profit from the balances of the books of accounts and skill of preparing a Balance Sheet at the end of the business period after providing for various adjustments.

(7) Skill of locating errors in the books of accounts and also to rectify them.

As regards the theoretical paper of the subject, teachers should help students know basic concepts and terms and to understand principles and procedures of accounting. It should be borne in mind that accounting principles and procedures are logically organised and are of general applicability. It is a well related, well organised subject discipline. A good knowledge of accounting principles together with accompanied skills may help students to become useful workers in business concerns and other offices. Although the purpose of teaching the subject is quite different from what we should aim at achieving in general stream courses there are certain common areas in the syllabus in Accountancy. So a teacher may gain if they go through the relevant units of discussion made in the Teaching Guidelines on Non-Laboratory-based subjects (pages 67-74). Such study may help him to determine the degree of emphasis he should put upon the mechanical aspects of the course or upon the understanding aspect of the principles and procedures inherent in the subject.
